Memorandum to the Council of

Corporation of the Municipality of Temagami

Subject: Temagami North Water Storage Standpipe Evaluation - Progress Report

Memo No: 2025-M-077

Date: April 10, 2025

Attachment: Appendix A - TULLOCH Working Paper No. 1

Prepared By: Laala Jahanshahloo - CAO/Treasurer

Recommendation

BE IT RESOLVED THAT Council receives Memo 2025-M-077 as presented.

Contents

1.Executive Summary

The Municipality of Temagami faces critical challenges in rehabilitating the Temagami North water standpipe, originally constructed in 1972. Despite securing ICIP Green Stream funding, cost overruns and technical uncertainties have necessitated a comprehensive reassessment. Key findings reveal systemic hydraulic deficiencies, aging infrastructure, and risks associated with reusing the existing foundation. The standpipe cannot meet provincial pressure standards for domestic use or fire protection, even under static conditions. Hydraulic modeling confirms severe pressure shortfalls during emergencies, with fire flows falling below required thresholds. The water system operates at 97% capacity, while sewage systems show significant infiltration issues. A secondary engineering review by TULLOCH underscores the inadequacy of a like-for-like replacement and highlights foundational risks, conflicting with WSP's conditional endorsement of reuse. Immediate action is required to address infrastructure gaps, prioritize a new elevated storage facility, and secure funding for system upgrades.

2. Background

The Municipality of Temagami secured funding through the ICIP (Investing in Canada Infrastructure Program) Green Stream for the rehabilitation of the Temagami North water standpipe. Early planning identified cost increases beyond original estimates.

Following funding approval, WSP Engineering recommended replacing the standpipe with a steel-infused glass tank, citing long-term durability and cost efficiency. OCWA (Ontario Clean Water Agency) managed the design and tendering phases.

A preliminary report rated the foundation as "good" but didn't confirm its reusability or provide contingency plans for failure, raising concerns about reliability and fire suppression during construction.

To address this, the Municipality engaged Tulloch Engineering for a secondary assessment, including foundation analysis, water modeling, and evaluation of replacement and rehabilitation options.

Following Resolution 2024-427, the Municipality initiated the project. Working Paper No. 1 is the first progress report for Engineering Consulting Services on the Temagami North Water Storage Improvements.

3. Key Highlights

3.1. Critical Deficiencies Identified:

- The existing water storage standpipe (built in 1972) cannot meet hydraulic pressure requirements for domestic use or fire protection under current or emergency demand scenarios.
- Low pressures persist across the system, even during static (no-flow) conditions.

3.2. Foundation Uncertainty:

- The standpipe's concrete foundation is visually intact but has seepage issues and lacks critical design/geotechnical data.
- Reusing the foundation for a new standpipe is not recommended without costly invasive inspections and repairs.

3.3. High Risk of Like-for-Like Replacement:

- Rehabilitating or replacing the standpipe at the same height/size will not resolve hydraulic inadequacies.

3.4. Water and Sewage System Capacity:

- Water system operates at 97% capacity (6 new connections available).
- Sewage system operates at 78% capacity (53 new connections available).
- High per capita water/sewage flows indicate leaks (water) and inflow/infiltration (sewage).

4. Main Findings

4.1. Existing Standpipe and Infrastructure

- Standpipe:
  - Capacity: 161,000 imperial gallons (1972).
  - Recoated in 2013; interior/exterior touch-ups recommended by 2021.
  - Contains hazardous materials (lead paint, asbestos).
- Water Distribution System:
  - Aging pipes (10–50 years old) with suspected tuberculation/fouling.
  - Low Hazen-Williams C-factors (calibrated to 12–32), indicating severely degraded pipes.

4.2. Hydraulic Modelling Results

- Pressure Shortfalls:
  - Static Conditions: Minimum pressure = 190–200 kPa (27–29 psi) at nodes near the standpipe (below MECP's 280 kPa/40 psi threshold).
  - Fire Flow Scenarios:
    - 67 L/s Fire Flow: Entire system experiences negative pressures (unsustainable).
    - 38 L/s Fire Flow: Partial system failure (negative pressures on Hillcrest Drive).
- Hydrant Flow Tests: Maximum available fire flow = 27 L/s (with one pump operational), well below required standards.

4.3. Foundation Limitations

- 2024 WSP Inspection:
  - No structural guarantees due to missing as-built/geotechnical data.
  - Reuse requires post-excavation inspections and modifications.

- Greatario’s $1.6M Bid: Assumed foundation reuse, but this is high-risk without further investigation.

4.4. Environmental Assessment Pathways

- Schedule A (Pre-Approved): Applicable only for simple recoating.
- Schedule B (Public Consultation): Required for replacement or major upgrades.

4.5. System Cannot Meet Demand

- Existing standpipe cannot meet current or future demand due to insufficient hydraulic head.
- System pressures fall below MECP and Fire Underwriters Survey guidelines.
- Pipe degradation and lack of redundancy exacerbate operational risks.

5. Recommendations for Council

5.1. Reject Like-for-Like Standpipe Replacement

Prioritize a new elevated storage facility with greater height/capacity.

5.2. Advance Working Paper 2

Evaluate alternatives, including:

- Looping dead-end watermains.
- Pipe cleaning/replacement.
- New storage tank designs (e.g., glass-fused steel).

5.3. Address Foundation Risks:

Budget for potential new foundation construction or major retrofits.

5.4. Initiate System Upgrades:

- Leak detection (water) and infiltration reduction (sewage).
- Apply for grants to fund investigations/upgrades.

5.5. Prepare for Schedule B EA:

Begin public consultation if replacement/upgrades proceed.

6. How Reports Inform Council Decisions

6.1. Key Findings from Both Reports

TULLOCH Working Paper 1 (Mar 2025)	WSP Foundation Inspection Report (Feb 2024)
Hydraulic Inadequacy: Existing standpipe cannot meet MECP or fire protection pressure standards.	No assessment of hydraulic function—focus is solely structural.
Foundation Reuse Discouraged: Lacks as-builts, has seepage issues, unknown capacity. Visual-only inspection limits confidence.	Foundation rated in “good” condition visually, with recommendations for reuse *if* modified and confirmed post-demolition.
Seepage Risk Identified: Subgrade pump chamber has water infiltration; insulation saturated.	Subgrade chamber observed as submerged; recommends leak investigation.
Recommendation: Construct new elevated storage facility to resolve both hydraulic and structural issues.	Reuse is conditionally possible—modifications like new anchors, pad extension, and repairs are required. No guarantee until full exposure.
Like-for-Like Replacement Not Viable: Same height tank will not fix system-wide pressure/fire flow problems.	Does not evaluate the implications of tank height on hydraulic performance.

6.2. Critical Overlaps and Conflicts

- Areas of Agreement
  - Seepage in Subgrade Chamber: Both reports flag water intrusion and recommend investigation.
  - Lack of Structural Records: Absence of as-builts and geotechnical data is a shared concern.
  - Structural Uncertainty: Both confirm further inspection would be required post-demolition to finalize reuse.
- Conflicting Positions - Foundation Reuse
  - TULLOCH: Advises against reuse due to cumulative risk (hydraulic + structural + unknowns).
  - WSP: Says reuse is possible, but only after demolition and if modifications are made — no guarantee offered.

6.3. Implications of Proceeding with WSP's Recommendation

- Potential Short-Term Cost Savings
  - Reuse could avoid full foundation replacement, aligning with Greatario's ~$1.6M bid (which assumes reuse).
- Significant Risks
  - Hydraulic Deficiencies Unresolved - Pressure and fire flow failures will persist with same-height standpipe, regardless of foundation condition.
  - Hidden Structural Defects - Below-grade portions were not inspected; risk of deterioration or voids beneath the slab.
  - Seismic Code Non-Compliance - WSP confirms existing foundation does not meet modern seismic codes.

- Post-Demolition Surprises - WSP requires licensed structural engineer to approve reuse only after exposure, potentially delaying construction and adding costs.

7. Conclusion

The Temagami North Water Storage Standpipe evaluation underscores critical infrastructure risks, including hydraulic deficiencies, aging assets, and foundational uncertainties. Key inconsistencies between TULLOCH and WSP reports—particularly regarding foundation reuse and the viability of a like-for-like replacement—highlight the need for Council to prioritize long-term solutions over short-term fixes.

Municipality of Temagami, Ontario
Community of Temagami North
WATER STORAGE IMPROVEMENTS
Working Paper No. 1: Existing Water Storage Facility Evaluation

March 24, 2025
TULLOCH Project No. 241337

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APPENDICES

DISCLAIMER

This Report has been prepared by TULLOCH Engineering Inc. (‘TULLOCH’) for the sole and exclusive use of The Municipality of Temagami ('Client’) to support Water Storage Improvements in the Community of Temagami North (the ‘Project’). The Report shall not be used for any other purpose, or provided to, relied upon or used by any third party without the express written consent of TULLOCH.

A limited number of visits to the Site were completed; and as such, the information collected and presented herein applies to the time of the visits only.

This Report contains opinions, conclusions and recommendations made by TULLOCH using professional judgment and reasonable care for the purpose of the Project.

Use of or reliance on this report by the Client is subject to the following conditions:

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This report has been prepared with the degree of care, skill and diligence normally provided by engineers in the performance of comparable services for projects of similar nature. The scope of this report includes engineering evaluation only.

REVISION LOG

2025/03/24	0	Issued for Review	Ben Belfry, P.Eng.	Chris Stilwell, P.Eng.	Chris Stilwell, P.Eng.
Date (Y/M/D)	Rev.	Status	Prepared By	Checked By	Approved By
TULLOCH ENGINEERING INC.					

REPORT PREPARATION & REVIEW

Prepared by:

March 24, 2025

Ben Belfry, P. Eng.

Reviewed by:

March 24, 2025

Chris Stilwell, P. Eng.

1. INTRODUCTION

1.1 General

The Community of Temagami North is located within the Municipality of Temagami. Temagami North is approximately 5 kilometres north of Temagami and approximately 50 kilometres south of Temiskaming Shores on TransCanada Highway 11 as shown in **Figure 1.1**.

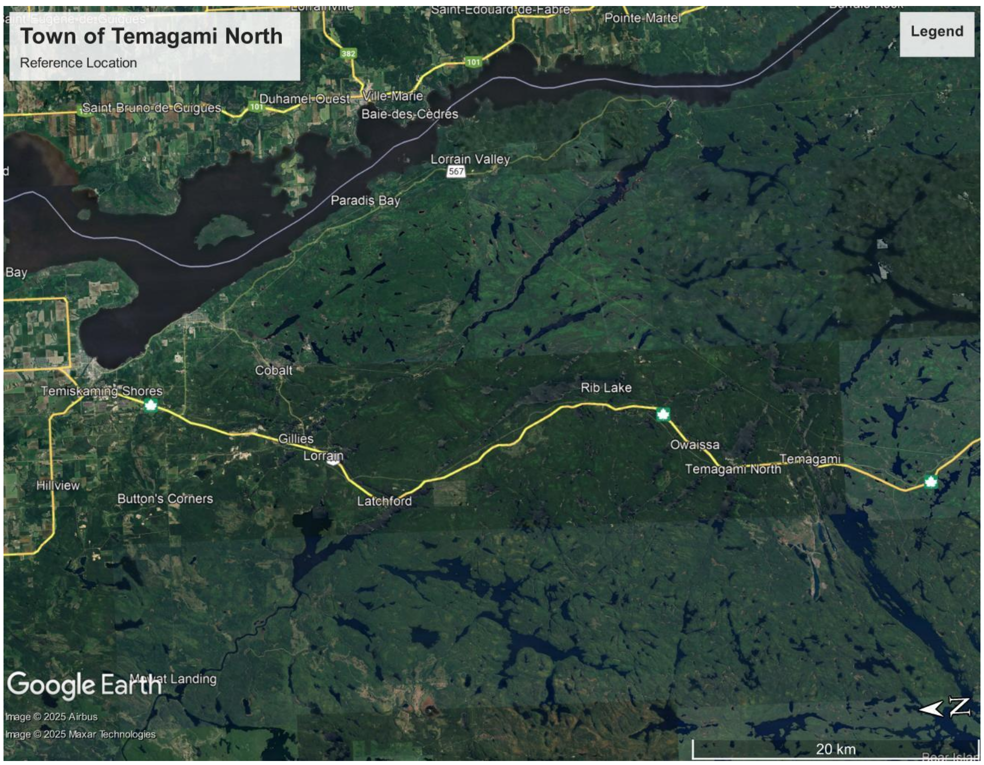

Figure 1.1 Location of Temagami North

1.2 Scope of this Report

The Municipality of Temagami retained TULLOCH Engineering Inc. (TULLOCH) to complete an evaluation of the municipal potable water storage standpipe in Temagami North known as the "North Tower."

TULLOCH is completing the project in a staged approach. The staged approach gives the Municipality adequate information to assess simpler rehabilitation options (like recoating the existing standpipe) before proceeding to more complex replacement solutions (like a new storage facility in a new or same location).

This Working Paper 1 is based on engineering hydraulic modelling and analysis of the existing standpipe to recommend if it should be rehabilitated by recoating or replaced with a like-for-like replacement (size and height) that could include a coated steel or glass lined standpipe. Working Paper 1 evaluates the existing system conditions and establishes the "problem definition" (i.e. low pressure and low flow under existing conditions). Any areas of low pressure during static, average day demand, maximum day demand, and fire flows are identified along with identified and suspected deficiencies in the system. Working Paper 1 includes a hydraulic model for the existing water supply, distribution system, and storage facility.

Working Paper 2 will evaluate alternatives and costs of any other improvements needed to address existing storage deficiencies and meet future needs, if any. Alternatives to be evaluated in Working Paper 2 may include a new standpipe or elevated water storage tank on a new foundation at the existing site.

1.3 Municipal Sewage and Potable Water Systems Capacity Analysis

At the Municipality's request, TULLOCH also completed an evaluation of the current capacity of the existing drinking water system and sewage disposal system in Temagami North for the purpose of potentially adding additional loading for planned future infilling. This work was beyond the original scope of this Working Paper No. 1, however, the results of the capacity assessment are included as Temagami North Water and Sewage System Capacity Review, dated February 27, 2025, in **Appendix A**.

1.4 Municipal Engineer's Class Environmental Assessment

The work plan approved by the Municipality included the preparation of two (2) Working Papers (technical memorandum) that can be incorporated into a Municipal Engineer's Class Environment Assessment (MEA Class EA), if needed. The MEA Class EA, developed by the Municipal Engineers Association, streamlines the environmental assessment process for municipal projects, eliminating the need for individual assessments. It classifies projects as Schedule A (pre-approved), Schedule B (with potential environmental impacts), Schedule C (complex projects with greater environmental effects), or exemptions. Exempt projects include maintenance and small-scale efforts. Schedule B involves consultation with affected parties. Schedule C mandates a comprehensive planning framework, and an Environment Study Report open for public and regulatory review.

If rehabilitation of the existing standpipe is the preferred solution, then the Municipality can proceed with the works as a pre-approved project under Schedule A of the Class EA. If a replacement, and other potential system upgrades are identified to meet existing and future needs, then completion of an EA under Schedule B may be required.

Both working papers can be used to support funding applications as well as advance the Schedule B EA and public consultation, if needed. This approach helps secure funding for small water system improvement projects.

1.5 Description of the Existing Drinking Water System

The Temagami North Drinking Water System is classified as a Large Municipal Residential Drinking Water System which serves an estimated population of 300 people. It is a standalone system not connected to another drinking water system. The Ontario Clean Water Agency (OCWA) operates the system for the Municipality.

The Municipal Drinking Water License was renewed with the Ontario Ministry of Environment Conservation and Parks, *MECP*¸ on July 10, 2021, under license number 201-102 and Issue number 3. The license expiry date is July 10, 2026, with application for license renewal required by January 10, 2026. The Drinking Water Works Permit was also renewed on July 10, 2021, under permit number 201-102, issue number 4 by the MECP. The MECP completed the 2024-2025 inspection of the Temagami North drinking water system No. 1-334412482 and it is summarized in an inspection letter dated July 26, 2024. No required actions resulted from the MECP inspection.

1.5.1 Water Treatment Plant

The water treatment plant (WTP) is located at 5 Cedar Avenue, and consists of the following major components:

- A raw water gravity intake from Net Lake.
- A low lift pumping station consisting of a wet well and two submersible pumps, rated for 3.8 L/s each, that discharge to two BCA treatment plants.
- The BCA plants each consist of 2 flash mixing chambers, 2 flocculation tanks, two clarification chambers, and two deep dual media filters (sand/anthracite). Aluminum sulphate and polymer are added for the coagulation/flocculation process, sodium carbonate for pH adjustment and sodium hypochlorite for disinfection.

- The BCA plants discharge to the three clear wells with combined capacity of 268.9 m^3 at 2.9 m depth for potable water storage.

- Two Goulds high lift pumps discharge to the distribution system and standpipe. Quality is monitored before entering the water distribution system. The high lift pumps typically operate one at a time as duty and standby. Each high lift pump is rated at 828 m^3/day (9.6 L/s or 126 IGPM) at 46 m (65 psi) total dynamic head. The high lift pumps discharge through a 75 mm (3”) diameter pipe to a 100 mm (4”) diameter common header and Endress and Hauser flow meter which is reduced-down to 83 mm (3-1/4”). After the flow meter, the discharge piping increases back to a 100 mm diameter prior to an increase in diameter to 150 mm (6”) to connect to the distribution network.

- The WTP is equipped with a 80 kW diesel generator complete with automatic start and fuel tank of 620 L to provide emergency power to the entire facility.

- The plant is equipped with an automated monitoring system (SCADA) that records various components of the process including system flows, pressures and chemical dosages. The potable water leaving the plant is continuously monitored for flow, pressure, pH, temperature, turbidity and free chlorine residual to ensure the water is of acceptable quality before entering the distribution system.

1.5.2 Water Distribution System

The water distribution system consists of approximately 2 kilometers of watermain with 189 service connections, 21 fire hydrants, and 7 dead end locations. The watermains range in nominal diameter from 150 mm (6”) to 250 mm (10”) with some 350 mm (14”) and are mostly made of cast or ductile iron material with PVC pipe on Spruce Drive. It is suspected that the older iron pipes could be as old or older than the standpipe which dates to 1972. The PVC pipe on Spruce Drive appears to have been installed in about 2015. The age of the system is estimated to vary from 10 to 50 years.

There is one bleeder in the subject area on Poplar Crescent, running full time to maintain water quality and prevent freezing in the winter months.

The availability of design and as-recorded drawings is limited. Issued for Construction Drawings by EXP dated May 31, 2016 are available for Spruce Drive. The balance of pipe sizes and layout were based on available information from OCWA and Municipal Staff.

1.5.3 Water Storage Standpipe

The water storage standpipe is located on a service road located off the north limit of Birch Crescent. This is the highest elevation within the distribution system. The water storage standpipe has a nameplate on it with the following information:

- Fabricator: Horton Steel Works, Limited
- Year: 1972
- Capacity: 161,000 Imperial Gallons
- Nominal Diameter: 24-0 feet
- Height: 58-0 feet

The standpipe was recoated in 2013. In 2016, it appears that modifications were made to the standpipe that included select recoating and installation of a mixing system.

The standpipe had a secondary disinfection booster station added to it in 2021. Equipment added includes a chlorine residual analyzer, a sodium hypochlorite chemical feed pump, and a 220 L double walled sodium hypochlorite chemical tank.

Design and as-recorded drawings are not available for the standpipe so pipe sizes and layout are based on field observations and discussions with OCWA Staff.

1.5.4 Existing Water System Drawings and Schematics

Based on the limited information available, TULLOCH developed a layout drawing of the Water System (**Appendix B**). Available schematics of the water distribution system and water treatment plant are included in **Appendix C**.

2. REVIEW OF BACKGROUND REPORTS

TULLOCH was provided with several background reports and other documents by the Municipality and OCWA Operations and Engineering. A summary review of the pertinent information follows.

2.1 Existing Standpipe Coating

In 2013, the Municipality of Temagami retained EXP to tender for re-coating of the existing standpipe. The Municipality completed the recoating work around 2013 with contractor Jacques Daoust Coatings. According to the Tender Report and Recommendation, the work cost approximately $174,250.00 when it was completed around 2013.

2.2 Landmark Municipal Services 2016 Photograph Log

A series of photographs from 2016 show what appears to be installation of a mixing system on the inlet pipe to the standpipe and recoating of the inlet and outlet pipe.

2.3 Inspection of Coating Systems

OCWA retained Landmark Municipal Services on the Municipality's behalf to complete a Remotely Operated Vehicle (ROV) Inspection and Report, dated November 1, 2019. The ROV Inspection and Report included a Protective Coatings and Linings Report recommending the interior lining of the tank should be touched up within the next one to two years of the report date. Interior lining work was anticipated to include abrading any corroded areas and applying NSF-61 approved epoxy according to manufacturer's specifications. The Protective Coatings and Linings Report also recommended the exterior coating receive cleaning and touch-up of all rust spots with an epoxy/polyurethane finish within the next one to two years of the report date. The proposed exterior coating would potentially extend the life of the existing coating another 7-10 years. Other repairs in the ROV Inspection and Report include repainting the valve pit, replacing the fall arrest system and ladder repairs, install padlock on tank hatch, remove and replace hatch to tank, and clean corrosion and sediment from the tank interior.

Landmark Municipal Services provided Quotation #Q19133, in the ROV Inspection and Report, for all recommended upgrades and repairs. The total quoted cost for all recommended upgrades and repairs ranged from $176,550.00 to $241,500.00. The recommended riser pipe investigation remained uncertain of cost, providing a range in the quoted upgrades and repairs.

2.4 Designated Substances and Hazardous Building Materials

OCWA commissioned SafeTECH Environmental Inc. on the Municipality's behalf to complete a Designated Substances and Hazardous Building Materials Assessment Report, dated February 5, 2024. The report determined the presence, location, condition, and quantities of designated substances and other hazardous materials that have the potential to be disturbed as part of planned construction activities. The following provides a summary of the SafeTECH Environmental Inc's. conclusions and recommendations:

- Suspected asbestos containing materials (ACM) present are grey exterior roof edge caulking, electrical wiring insulation, and built-up roof membrane.

- Paint chip analysis to determine lead content indicated that green paints associated with the standpipe exterior and the pipes within the valve chamber were confirmed to be lead-containing.
- Fluorescent lamps are suspected to contain mercury vapour present within the lamps.
- Silica-containing materials were identified to be present in the subject structure.

2.5 Foundation Inspection

OCWA commissioned WSP, on the Municipality's behalf, to complete the Temagami North Standpipe Foundation Inspection, dated February 26, 2024. An above grade condition assessment completing visual examination of the concrete foundation and steel anchors was completed. The assessment determined the existing concrete was in good condition, however, did not recommend using the existing foundation for a like-for-like standpipe replacement. WSP recommended modifying the existing foundation with any standpipe replacement. Modifications included completing local repairs and improvements to concrete and steel anchor deficiencies found during investigation. Additionally, seepage in the subgrade chamber was observed. Further investigation was recommended to determine the source of water leakage.

Email correspondence with OCWA and the Municipality, dated July 26, 2024, reviews discussion with WSP regarding the use of the existing foundation for a new glass fused to steel (GFS) standpipe to replace the existing welded steel tank. WSP provided the following summarized statement to complement the previous Standpipe Foundation Inspection, dated February 26, 2024: "Due to the limited available existing information (e.g. as-builts, reinforcement, design loads, and geotechnical reports[s]), WSP cannot guarantee the existing condition of the concrete foundation, aside from visual observation provided in the February 26, 2024 inspection report."

"The final modification/decision is still dependent on detailed inspection after the removal of the existing standpipe and excavation around the foundation to expose the whole foundation. WSP has specified, as part of the design-build process, that the new tank designer is to retain a licensed in Ontario structural engineer to make the final decision on whether the existing foundation can be modified and reused based on the detailed inspection."

With uncertain suitability of modifications and repairs to the existing foundation condition without committing to major work and invasive inspection, the Municipality concluded that the reuse of the existing standpipe foundation could not be determined with confidence.

2.6 OCWA Tender and Greatario Engineered Storage Systems Bid

OCWA received a Rate Bid Form dated June 13, 2024 from Greatario Engineered Storage Systems on the Municipality's behalf. The Bid was approximately $1.6M for construction in Spring 2025 of a size-for-size glass fused to steel standpipe including design, engineering, and construction. The Bid was based on reuse of the existing foundation including select improvements.

3. HYDRANT FLOW TESTS

On November 28, 2024 TULLOCH with assistance of OCWA and the Municipality completed hydrant flow tests to assess the actual capabilities of the system and to calibrate the hydraulic model to be developed by TULLOCH. A limited number of tests were conducted due to weather and to not exceed the rated capacity of the drinking water system. The water flow test reports are included in **Appendix D** and summarized below in Table 3.1 and 3.2.

Table 3.1 Summary of Hydrant Flow Test Results

Test #	Test Hydrant No. (Node)	Analysis (Residual) Hydrant No. (Node)	Reading During Test at Test Hydrant			
			Pitot Pressure		Flow	
			psi	kPa	USGPM	L/s
1	9	10	6	41	383	24
2	20	19	6	41	389	25
3	28	3	5	34	356	23
4	28	3	8	55	437	28

Table 3.2 Summary of Hydrant Flow Test Results

Test #	Static Pressure in Analysis Hydrant Before Test, psi	Residual Pressure in Analysis Hydrant During Test, psi	Calculated Results at Analysis Hydrant			
			Pressure		Flow	
			psi	kPa	USGPM	L/s
1	34	16	20	138	334	21
2	46	13	20	138	342	22
3	46	12	20	138	313	20
4	46	18	20	138	419	27

Note: One high lift pump was operating during Test #4.

4. HYDRAULIC MODEL OF EXISTING WATER SYSTEM

4.1 Description of Existing System Included in Model

The general layout of the drinking water system is shown in Drawing WM1 in **Appendix B.** The model of the drinking water system comprises the standpipe, water distribution system, and high lift pumps in the WTP.

4.1.1 Standpipe Model Setup

TULLOCH completed a limited topographic survey on November 28, 2024 and established the datum for the standpipe as the finished floor at elevation 316.90 m. Based on the available data, the following elevations and heights were established for the model as shown below in Table 4.1.1.1.

Table 4.1.1.1 Standpipe Model Elevations

Item	Height (m / ft)	Elevation (m)
Finished Floor Level	0.0	316.90
Bottom of Fire Storage[1]	8.6 (28)	325.35
Bottom of Equalization Storage[2]	15.0 (49)	331.90
Level during Hydrant Flow Tests[3]	15.7 (52)	332.60
Top of Equalization Storage[2]	16.3 (54)	333.20
Overflow	16.6 (55)	333.50
Roof	17.7 (58)	334.60

Note: 1) Estimated based on MECP Guidelines
2) From operating level provided by OCWA
3) From SCADA after tests

Model setup for the internal piping within the standpipe and valve chamber is based on field observation, photographs, and discussions with OCWA Staff.

4.1.2 Water Distribution System Model Setup

Node elevations within the water distribution system are determined from Ontario Ministry of Natural Resources and Forestry Digital Terrain Model (DTM). The DTM information provides node elevations of the ground surface. To validate using the DTM, node elevations are compared to finish grade shown on the EXP Spruce Drive Reconstruction drawings. All modelled node elevations along Spruce Drive using the DTM are within approximately 1 m of the finished grade shown on the EXP drawing set. These modelled nodes result in an approximate variance of 1.4

psi between potential actual and modelled pressures and are considered to have adequate accuracy for the purpose of this model.

4.1.3 Water Treatment Plant Model Setup

The limited topographic survey completed on November 28, 2024 established the datum for the WTP as the finished floor at elevation 297.7 m. Based on the available data and field measurements the elevation of the treated water in all three clear wells when full is approximately 296.9 m and the bottom of the clear wells is approximately 294.04 m. The rated (or firm) capacity of each high lift pumps at the WTP is 828 m^3/day (9.6 L/s or 126 IGPM) at 46 m (65 psi) total dynamic head.

4.2 Modelling Software

The model used is EPA_NET 2.2 to model the pressurized water system. EPA_NET 2.2 is a tool developed for understanding the movement and fate of drinking water constituents within distribution systems. This software can be used for many different types of applications in the analysis of distribution systems. The model uses a tank to represent the standpipe, and it models a high lift pump at the WTP.

During each simulation, the modeling software calculates and updates the head at each junction, flow rate in each pipe, and level in the standpipe at specified time based on user-defined demands and standpipe levels. To accomplish this, the model simultaneously solves the conservation of flow and head loss equations for each corresponding junction and links through an iterative technique.

The required input parameters for the model are as follows:

- Pipes
  - Diameter
  - Material type
  - Roughness
  - Length
- Junctions
  - Elevation
  - Water demand
- Tanks
  - Elevation
  - Initial level
  - Minimum level
  - Maximum level
  - Diameter
  - Minimum Volume
  - Volume supply curve

The input values for the above parameters are gathered from numerous resources consisting of the Municipality's personnel, treatment plant SCADA data, existing as-built drawings, site investigation, MECP Design Guidelines for Drinking Water Systems, 2008, and Fire Underwriters Survey Water Supply for Public Fire Protection, 2020.

4.3 Model Inputs

4.3.1 Water Demand

The modelled water demand during average and peak demands is in accordance with the Temagami North Water and Sewage System Capacity Review, prepared by TULLOCH, dated February 27, 2025 **(Appendix A).** The model shows results for a unit count of 189 equivalent residential units (ERU). According to the Capacity Review, average domestic water demand is 578 L/capita/day with population density of 1.59 people/ERU. The total population is 300 people.

In order to accurately represent the water consumption throughout a typical day, peaking factors are used. The maximum daily rate factor is 1.83 in accordance with the Capacity Review. The peak hour demand was not provided in the Capacity Review information so the peak hour demand factor that is used in the model is based on the MECP Design Guidelines for Drinking Water Systems, 2008, Table 3-3 for an equivalent population of 300. The peak hour demand factor used in the model is 5.4.

Each demand is then uniformly adjusted for various demand scenarios to align with the Community's records. The average daily demand in the model is 2.0 L/s. The maximum day demand in the model is 3.7 L/s. The peak hour demand in the model is 10.9 L/s.

To determine capacity throughout the system during high demand emergency scenarios, three (3) fire flow demand scenarios are considered:

1. Table 7 of the Fire Underwriter's Survey, 2020, is used to provide an estimate of fire flow demand. The minimum building separation distances throughout the Community are observed between 3 m and 10 m. According to Table 7, for wood framed buildings at 3 m to 10 m separation, the fire flow is 4,000 L/min, or 67 L/s.

2. Table 8.1 in the MECP Design Guidelines for Drinking Water Systems, 2008, shows that storage for fire protection in a water storage facility (like a standpipe) is a 2-hour duration fire flow of 38 L/s for a population between 500 and 1000 people.

3. A fire flow at the Arena of 41 L/s.

The greater of maximum day demand plus fire flow or peak hour demand is considered for the capacity assessment. In this case, maximum day demand plus fire flow scenarios are significantly greater than the peak hour demand. Therefore, peak hour demand is not modelled.

4.3.2 Watermain Pipes

The roughness coefficient of the watermain pipes, *Hazen Williams C-Factor*, is typically used in modelling new systems in accordance with MECP Design Guidelines for Drinking Water Systems, 2008. The C-factor is 100 for all 150 mm diameter pipes. For all pipes between and including 200 mm and 250 mm, the C-factor is modelled to be 110.

To calibrate the model to attempt to simulate the actual system performance (i.e. the hydrant flow tests), the C-Factor is adjusted. In order to calibrate the model, Birch Crescent and the service easement to the standpipe requires a C-Factor of 23. The assumed 200 mm diameter watermain throughout Goward Avenue and Hillcrest Drive requires a calibrated C-Factor of 32. The assumed 250 mm diameter watermain throughout Cedar Avenue and Poplar Crescent requires a calibrated C-Factor of 12. C-Factor of 150 is used in modelling the stainless steel pipes within the WTP high lift pump chamber to provide calibrated results during high lift pump-on scenarios.

4.3.3 Water Treatment Plant

Treated water is pumped from the clear wells at the treatment plant by high lift pumps to the distribution system and the standpipe. Two pumps are available to pump the water, however, a single pump is typically operated at a time. Table 4.3.3.1 provides the tabulated pump curve of one (1) high lift pump at the WTP.

Table 4.3.3.1: Water Treatment Plant High Lift Pump Curve

Flow (L/s)	Total Dynamic Head (m of H_2O) (psi)
0	56.4 m (80 psi)
4.7	54.9 m (78 psi)
8.8	48.8 m (69 psi)
9.6	46.0 m (65 psi)
10.7	42.7 m (61 psi)
12.3	36.6 m (52 psi)
13.2	30.5 m (43 psi)

4.3.4 Standpipe

The volume curve used in the model, to represent the falling pressure head and supply of the standpipe, is shown in Table 4.3.4.1. The standpipe is 7.31 m in diameter and modelled with a maximum depth of 17.43 m.

The volume curve is applied to the standpipe at the modelled datum elevation. A full tank at the top of the operating range (top of the equalization storage) has a height of 16.3 m of head pressure and results in a hydraulic grade line with elevation of 333.2 m. To calibrate with pressure observed during testing completed on November 28, 2024, the standpipe is modelled with a head of 15.7 m as observed from SCADA measurement during testing or elevation 332.6 m.

Table 4.3.4.1 Standpipe Volume Curve

Standpipe Volume Curve		
Height (m)	**Elevation (m)**	**Volume (m^3)**
0.00	316.90	0
0.23	317.13	9.7
1.23	318.13	51.6
2.23	319.13	93.6
3.23	320.13	135.6
4.23	321.13	177.5
5.23	322.13	219.5
6.23	323.13	261.5
7.23	324.13	303.4
8.23	325.13	345.4
9.23	326.13	387.4
10.23	327.13	429.3
11.23	328.13	471.3
12.23	329.13	513.3
13.23	330.13	555.2
14.23	331.13	597.2
15.23	332.13	639.2
16.23	333.13	681.2
17.23	334.13	723.1
17.43	334.33	732.5

4.4 Model Calibration and Validation

The model was calibrated under two (2) scenarios: one that isolates the supply to just the standpipe to assess the capacity of the standpipe exclusively; and, second where supply assistance from a high lift pump at the treatment plant is considered. During on-site hydrant testing completed November 28, 2024, it was observed that the high lift pumps did not engage during fire flow demand rate over a brief period.

After creating the water distribution network in EPA_NET 2.2, comparison assessments were completed to calibrate and validate the model results to the existing system under static and demand (fire flow) conditions. Minor losses, due to fittings and valves, within the Standpipe and High Lift Pump chamber are considered. The WTP is assumed to supply Cedar Avenue and ultimately the remainder of the distribution system with 250 mm diameter PVC watermain along the service road to the WTP. Watermain roughness throughout the distribution system, aside from reconstructed Spruce Drive, is manipulated to calibrate modelled pressures in accordance with on-site hydrant testing completed November 28, 2024.

Table 4.4.1 summarizes the pressures measured by TULLOCH, the modelled pressures at the same testing locations, and the percent error between the two values. The percent error calculation uses the measured pressure as theoretical correct pressure and the modelled pressure as the experimental value. Table 4.4.1 shows an insignificant percent error, less than 5%, between measured and modelled pressure results during standpipe isolated scenarios. Test #4, modelling the single high lift pump-on scenario, shows error of 9 % or 2.5 psi during Scenario 4. Therefore, modelling results are deemed to be representative.

Table 4.4.1 Percent Error Between Measured Pressure and Modelled Pressure

Testing Location	Residual Measured Pressure (psi)	Calibrated Modelled Pressure (psi)	Percent Error
Test #1 at JU10, with 0 L/s Flow at JU9	34	33	2.4 %
Test #2 at JU19, with 0 L/s Flow at JU20	46	47	1.5 %
Test #3 at JU3, with 0 L/s Flow at JU28	48	48	0.6 %
Test #1 at JU10, with 25 L/s Flow at JU9	16	16	0.1 %
Test #2 at JU19, with 24 L/s Flow at JU20	13	13	1.1 %
Test #3 at JU3, with 22 L/s Flow at JU28	12	12	3.2 %
Test #4 at JU3, with 27 L/s Flow at JU28	18	16	8.7 %

Note: One high lift pump was operating during Test #4.

The existing watermain condition is unknown at the time of testing and modelling. Various unknown factors due to watermain age could affect dynamic flow results. For the purpose of assessing if the existing standpipe height is sufficient, the model is considered calibrated and validated with adequate accuracy.

4.5 Design Requirements

In accordance with MECP Design Guidelines for Drinking Water Systems, 2008 (Section 8.3), the pressure design criteria are as follows:

- Acceptable range between 28 m of H_2O (275 kPa / 40 psi) and 70 m of H_2O (700 kPA / 100 psi) during average day, maximum day and peak hour demands.
- Preferred range between 35 m of H_2O (350 kPa / 50 psi) and 49 m of H_2O (480 kPa / 70 psi) during average day, maximum day and peak hour demands.
- Minimum pressure during maximum day demand plus fire flow of 14 m of H_2O (140 kPa / 20 psi).

4.6 Modelling Results and Discussion

Based on the information documented previously, input data is generated and entered into the model. Tabulated Node Demand (WM2) input data is include in **Appendix E.** Detailed results generated by the various model scenarios Schematic and Tabulated Node Results (WM3) as described below are included in **Appendix F**.

4.6.1 Scenario 1: Average Day Demand

The average day demand model results in inadequate pressures throughout several nodes under calibrated conditions, with standpipe depth of 15.7 m and High Lift Pump off. The minimum pressure in Scenario 1 is 196 kPa (28 psi) at Node JU11, the first servicing node from the standpipe. The maximum pressure is 338 kPa (49 psi) at Node JU5, the intersection of Spruce Drive and Hazel Circle. The north half of Birch Cresent, from approximately 8 to 41 Birch Crescent, and south half of Hillcrest Drive, from approximately 15 to 31 Hillcrest Drive, have inadequate pressure, below 280 kPa (40 psi). The remainder of the distribution system is supplied with acceptable pressure between 280 kPa (40 psi) and 350 kPa (50 psi). No nodes in the Scenario 1 model are supplied with preferred pressure of 350 kPa (50 psi) to 480 kPa (70 psi). A summary of Scenario 1 results are found in Table 4.6.1.1.

Table 4.6.1.1 Existing Conditions Average Day Demand

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System Under Calibrated Conditions	338 kPa (49 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Minimum Pressure in System Under Calibrated Conditions	196 kPa (28 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Maximum Velocity	0.06 m/s		

4.6.2 Scenario 2: Maximum Day Demand

The maximum day demand model results in inadequate pressures throughout several nodes under calibrated conditions, with Standpipe depth of 15.7 m and High Lift Pump off. The minimum pressure in Scenario 2 is 195 kPa (28 psi) at Node JU11, the first servicing node from the Standpipe. The maximum pressure at equalization level low is 338 kPa (49 psi) at Node JU5, the intersection of Spruce Drive and Hazel Circle. The north half of Birch Cresent, from approximately 8 to 41 Birch Crescent, and south half of Hillcrest Drive, from approximately 15 to 31 Hillcrest Drive, have inadequate pressure, below 280 kPa (40 psi), during calibrated conditions. The remainder of the distribution system is supplied with acceptable pressure between 280 kPa (40 psi) and 350 kPa (50 psi). No nodes in the Scenario 2 model are supplied with preferred pressure of 350 kPa (50 psi) and 480 kPa (70 psi). A summary of Scenario 2 results are shown in Table 4.6.2.1.

Table 4.6.2.1 Existing Conditions Maximum Day Demand

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System Under Calibrated Conditions	338 kPa (49 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Minimum Pressure in System Under Calibrated Conditions	195 kPa (28 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Maximum Velocity	0.12 m/s		

4.6.3 Scenario 3: Maximum Day Demand Plus 67 L/s Fire Flow, High Lift Pump On

The Scenario 3 model applies 67 L/s (1,060 USGPM) of fire flow demand at Node JU30 (Hillcrest Drive), in addition to maximum day demand throughout all nodes. JU30 is selected as the worst-case fire flow node due to it located furthest distance from the Standpipe and High Lift Pump and has a high elevation node relative to the remainder of the system. The Scenario 3 model under calibrated conditions has a Standpipe depth of 15.7 m and High Lift Pump on. The Scenario 3 model shows inadequate supply is provided to the entirety of the distribution system. The entirety of the distribution system results in negative pressures under calibrated conditions. Therefore, all nodes have resultant pressures less than 20 psi. The calibrated system cannot supply 67 L/s fire flow to JU30 plus maximum day demand.

The greatest observed pressure is at Node JU11, the first servicing node from the standpipe. The lowest observed pressure is at JU30, the south limit of Hillcrest Drive and point of fire flow loading. Under calibrated conditions, Node JU11 is -90 kPa (-13 psi) and Node JU30 is at -1549 kPa (-225 psi). A summary of Scenario 3 results are found in Table 4.6.3.1.

Table 4.6.3.1 Existing Conditions Maximum Day Demand Plus 67 L/s Fire Flow

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System Under Calibrated Conditions	-90 kPa (-13 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Minimum Pressure in System Under Calibrated Conditions	-1549 kPa (-225 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Maximum Velocity	3.83 m/s		

4.6.4 Scenario 4: Maximum Day Demand Plus 38 L/s Fire Flow, High Lift Pump On

The Scenario 4 model applies 38 L/s (600 USGPM) of fire flow demand at Node JU30 (Hillcrest Drive), in addition to maximum day demand throughout all nodes. JU30 is selected as the worst-case fire flow node due to it located furthest distance from the Standpipe and High Lift Pump and has a high elevation node relative to the remainder of the system. The Scenario 3 model under calibrated conditions has a Standpipe depth of 15.7 m and High Lift Pump on. The Scenario 4 model shows inadequate pressure supply is provided to the distribution system. Under calibrated conditions, Nodes JU2 and JU27, Cedar Avenue south of the intersection with Poplar Crescent, and JU4, JU5, and JU7, Spruce Drive east of the intersection with Cedar Avenue, have pressure greater than 140 kPa (20 psi). The remainder of the distribution system has inadequate pressure, less than 140 kPa (20 psi). Hillcrest Drive and the south limit of Goward Avenue result in negative pressures. The calibrated system cannot supply 38 L/s fire flow to JU30 plus maximum day demand.

The greatest observed pressure is at Node JU5, the intersection of Spruce Drive and Hazel Circle. The lowest observed pressure is at JU30, the south limit of Hillcrest Drive and point of fire flow loading. Under calibrated conditions, Node JU5 is 138 kPa (20 psi) and Node JU30 is at -379 kPa (-55 psi). A summary of Scenario 3 results are found in Table 4.6.4.1.

Table 4.6.4.1 Existing Conditions Maximum Day Demand Plus 38 L/s Fire Flow

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System Under Calibrated Conditions	138 kPa (20 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Minimum Pressure in System Under Calibrated Conditions	-379 kPa (-55 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Maximum Velocity	2.19 m/s		

4.6.5 Scenario 5: Maximum Day Demand Plus 41 L/s Fire Flow, High Lift Pump On

As requested by the Fire Chief, the Scenario 5A model applies 41 L/s (650 USGPM) of fire flow plus maximum day demand at Node JU7 closest to the Arena on Spruce Drive. The Scenario 5A model under calibrated conditions has a Standpipe depth of 15.7 m and High Lift Pump on. The Scenario 5A model shows inadequate pressure supply is provided to the entire distribution system. Negative pressures are observed at the south limit of Hillcrest Drive, from approximately 23 to 31 Hillcrest Drive. The remainder of the development can receive the specified demands at pressures between 0 kPa (0 psi) and 97 kPa (14 psi). The greatest instantaneous pressure is Node JU12 with 97 kPa (14 psi). The lowest instantaneous pressure is Node JU30 with -12.8 kPa (-1.86 psi).

The Scenario 5B model is calibrated with the fire level low, 8.6 m height in the standpipe. The entire system shows inadequate pressure results below 140 kPa (20 psi). At fire level low, the fire flow applied at Node JU7 results in negative pressures at JU6, JU9, JU10, JU17, JU18, JU24, JU25, JU29, and JU30. Negative pressures are shown along Hillcrest Drive, the south limit of Goward Avenue, the intersection of Spruce Drive and Birch Crescent, the east limit of Birch Crescent, and the north limit of Hazel Circle. The remainder of the distribution system has resultant pressures between 0 kPa (0 psi) and 31 kPa (5 psi). A summary of Scenario 4 results are found in Table 4.6.5.1. The greatest instantaneous pressure is Node JU2 with 31 kPa (5 psi). The lowest instantaneous pressure is Node JU18 with -64 kPa (-9 psi).

Table 4.6.5.1 Existing Conditions Maximum Day Demand Plus 41 L/s Fire Flow

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System Under Calibrated Conditions	97 kPa (14 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Minimum Pressure in System Under Calibrated Conditions	-12.8 kPa (-1.86 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Maximum Velocity	1.36 m/s		
Maximum Pressure in System at Fire Level Low	31 kPa (5 psi)	140 kPa (20 psi)	140 kPa (20 psi)
Minimum Pressure in System at Fire Level Flow	-64 kPa (-9 psi)	140 kPa (20 psi)	140 kPa (20 psi)

4.6.6 Scenario 7: Static Conditions

Static conditions are described as a theoretical situation where there is no water demand in the system either for domestic use or fire protection. In this case it assumed that a high lift pump is not operating. Under this static, no flow condition, the water pressure in the water distribution system is driven by water level in the standpipe. In accordance with MECP Guidelines, water pressure under static conditions should be between 350 kPa (50 psi) and 480 kPa (70 psi), however, due to certain conditions, the acceptable range is 280 kPa (40 psi) to 700 kPa (100 psi).

To model and show this scenario in a simple fashion, a drawing of the hydraulic grade line was developed and is included in **Appendix G.** As shown on Drawing WM4, two static scenarios can be considered where water level in the standpipe is at high normal operating level (high equalization level) and low normal operating level (low equalization level). A summary of the Scenario 6 results are found in Table 4.6.6.1.

Table 4.6.6.1 Existing Conditions Static Conditions

Modelling Condition	Model Result	Acceptable Value	Preferred Value
Maximum Pressure in System at Equalization High	350 kPa (50 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Minimum Pressure in System at Equalization High	200 kPa (29 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Maximum Pressure in System at Equalization Low	330 kPa (48 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)
Minimum Pressure in System at Equalization Low	190 kPa (27 psi)	280-700 kPa (40-100 psi)	350-480 kPa (50-70 psi)

5. CONCLUSIONS

- According to the modelling results, at no point during any of the scenarios do all nodes within the water distribution system provide preferred or acceptable servicing pressures in accordance with MECP Guidelines for domestic water supply and fire protection.

- During static conditions, when pressures are at their greatest, the nodes closest to the standpipe on Birch Cresent receive inadequate pressure supply in the range of 190 to 200 kPa (27 to 29 psi) which is significantly less than MECP Guidelines of 280 (40 psi) acceptable and 350 kPa (50 psi) preferred. The nodes with lowest elevation along Cedar Avenue receive acceptable to preferred pressure in the range of 350 kPa (50 psi) under static conditions.

- During average day and maximum day demand scenarios the nodes closest to the standpipe on Birch Cresent and the southern part of Hillcreadt Drive receive inadequate pressure supply less than 280 kPa (40 psi). The furthest nodes with respect to distance from the WTP and standpipe, on Hillcrest Drive, receive inadequate pressure supply throughout the average day demand and maximum day demand event. The remainder of the system receives acceptable pressure between 280 kPa (40 psi) and 350 kPa (50 psi), however, no part of the system receives preferred pressure above 350 kPa (50 psi).

- When water level in the standpipe is at 15.7 m depth, which is within the normal operating range and well above the design low fire storage level, pressures during maximum day demand plus fire flow are inadequate with less than 240 kPa (20 psi) even at a minimum fire flow of 38 L/s (600 USGPM) at the furthest nodes on Hillcrest Drive. As the demand duration continues for 2 hours (in accordance with MECP Guidelines) and the water level drops in the standpipe to fire storage level low, inadequate pressures expand throughout the watermain system.

- The system is unable to provide maximum day plus fire flow (67 L/s) demand at 240 kPa (20 psi) that would be the minimum in the Fire Underwriters Survey. All modelled pressures are negative during this demand scenario.

- The system model estimates, and the hydrant flow tests confirm, that the available fire flow is only about 21 L/s (334 USGPM) at 140 kPa (20 psi) on Birch Crescent, 22 L/s (342 USGPM) at 140 kPa (20 psi) on Hillcrest Drive and 20 L/s (311 USGPM) at 140 kPa (20 psi) on Cedar Avenue. Based on one hydrant flow test on Cedar Avenue, one high lift pump in operations improves fire flow on Cedar Avenue to 27 L/s (421 USGPM) and 140 kPa (20 psi).

- The inadequate head pressure caused by the low standpipe height results in normal demand pressures that do not meet MECP Guidelines. As water demands increase due to fire, the low standpipe height (or lack of fire pump system with adequate fire storage at the WTP) provides insufficient head pressure within the distribution system which may be exacerbated by high friction losses within the small diameter pipes and possibly fouled / tuberculated pipes.

- In order to calibrate the model to the actual hydrant flow tests, Hazen-Willaims C-Factors much lower than MECP Guidelines had to be used to simulate the actual conditions. This may indicate water valves that are not fully open but more likely old pipes that are fouled / tuberculated such that actual inside pipe diameter is much less than nominal.

- Increased head pressure in a higher water storage facility, watermain cleaning and/or replacement, and potential looping of the terminal watermain limits back to the Spruce Drive watermain would improve pressure during normal demand and fire flow scenarios.

- The system requires upgrades and additional infrastructure to adequately accommodate further development.

6. RECOMMENDATIONS

- It is not recommended to rehabilitate or replace the existing standpipe like-for-like based on low pressures even when the standpipe is full. Like-for-like replacement or rehabilitation will not address hydraulic pressure inadequacy.

- A new higher water storage facility should be investigated.

- Working Paper 2 should be completed to investigate improvements to the water storage facilities for the existing and future conditions.

- As part of Working Paper 2, improvements to the water distribution system should be investigated to provide adequate supply and pressure both currently and in the future.

- Working Paper 2 potential solutions may include:

- Looping the watermain system back to Spruce Drive from Hillcrest Drive and the Arena.

- Close the watermain gap between Poplar / Cedar and Goward / Hillcrest dead-ends to allow for future development and to provide redundancy, improved water quality, and improved flow and pressure.

- Investigate the advantages of cleaning, replacing and/or increasing the diameter of existing watermains.

- Although beyond the scope of Working Paper 1 or 2, additional hydrant flow tests should be completed to identify restrictions in the water distribution system (e.g. partially closed valves and/or low fouled / tuberculated watermains with low Hazen-Williams C-Factor) which could be targeted for rehabilitation (e.g. cleaning and relining) and/or replacement. Additional hydrant flow tests would also help to further validate and calibrate the model.

APPENDIX A

Water and Sewage System Capacity Analysis

February 27, 2025
241337

Municipality of Temagami
7 Lakeshore Drive
Temagami, Ontario
P0H 2H0

Attention: Laala Jahanshahloo, Chief Administrative Officer / Treasurer

Re: Temagami North Water and Sewage Systems
Capacity Review

Dear Ms. Jahanshahloo,

TULLOCH Engineering Inc. (TULLOCH) was retained in October 2024 by the Municipality of Temagami to complete engineering analysis and review of the North Temagami Water Storage Standpipe. During completion of the engineering for the North Temagami Water Storage Standpipe project, the Municipality requested in January 2025 that TULLOCH provide an additional assessment of available capacity in the Temagami North drinking water supply system and sewage disposal system. The Municipality is considering expanding the water and sewer system to allow development of a previously approved plan of subdivision.

In late January 2025, OCWA provided the Municipality with water and sewage system data that also included an analysis of capacity based on Ministry of Environment Conservation and Parks Policy D-5-1 (OCWA memo and Policy D-5-1 are appended). The Municipality provided OCWA's data to TULLOCH.

TULLOCH has competed a capacity review following the principles of Policy D-5-1 using the data provided by OCWA. D-5-1 is used to calculate uncommitted reserve capacity (i.e.. capacity that would be available for new plans of subdivision). The principles in D-5-1 can be used to calculate the current available capacity within the existing system to allow for infilling and system expansion to connect a previously approved plan of subdivision.

<u>Water</u>

Rated Capacity of Water Treatment Plant:	328 cu.m./day
Average Max. Day Demand:	317.25 cu.m./day (average of the without incident 4 years of records)

% of Rated Capacity:	**96.6% (317.25 / 328)**
Remaining Max. Day Capacity:	10.75 cu.m./day
Average of 5-Years Average Day Demand:	173.4 cu.m./day
Serviced Population:	300 people
Number of Connections:	189
Average Population per Connection:	1.59 (300 / 189)
Average per capita daily consumption:	0.578 cu.m./day
	(578 litres per person per day)
Average Day to Max. Day Peaking Factor:	1.83 (317.25 / 173.4)
Remaining Max. Day Capacity:	10.75 cu.m./day
Remaining Avg. Day Capacity:	5.87 cu.m./day (10.75 / 1.83)
Allowable Population to Rated Capacity:	**10 people (5.87 / 0.578)**
Allowable Connections to Rated Capacity:	**6 (10 / 1.59)**

Sewage

Rated Capacity of Sewage Treatment Plant:	390 cu.m./day
Average of 5-Years of Average Day Demand:	304 cu.m./day
% of Rated Capacity:	**78% (304 / 390)**
Remaining Avg. Day Capacity:	86 cu.m./day
Serviced Population:	300 people
Number of Connections:	189
Average Population per Connection:	1.59 (300 / 189)
Average per capita daily flow:	1.013 cu.m./day
	(1013 litres per person per day) (304 / 300)

Remaining Avg. Day Capacity:	86 cu.m./day
Allowable Population to Rated Capacity:	**85 people (86 / 1.013)**
Allowable Connections to Rated Capacity:	**53 (85 / 1.59)**

Conclusions

Water

1. The Temagami North water supply system is operating at about 97% of rated capacity.
2. There is sufficient capacity to connect about six (6) more typical units or about 10 people.

Sewage

1. The Temagami North sewage treatment system is operating at about 78% of rated capacity.
2. There is sufficient capacity to connect about fifty-three (53) more typical units or about 85 people.

Discussion

An average daily per capita water consumption of 578 litres per person per day is high and may indicate losses in the system which could be leaks, hydrant flushing and bleeds. The Ministry of Environment Conservation and Parks typical range is 225 to 450 litres per person per day and most communities are lower in the range due to water conserving fixtures.

An average daily per capita sewage flow of 1013 litres per person per day is extremely high and indicates serious inflow and infiltration into the system which could be groundwater infiltration into sewers or inflow from the surface into manholes or “illegal” connections like sump sumps and roof leaders connected to the sanitary sewers. The Ministry of Environment Conservation and Parks typical range is 225 to 450 litres per person per day.

Recommendations

1. The Municipality should complete a leak detection program for the water system to identify why per capita water consumption is higher than provincial standards.

2. The Municipality should complete an infiltration and inflow reduction program to identify why per capita sewage flow is so high compared to provincial standards.

3. The Municipality should consider completing a Municipal Engineer's Class Environmental Assessment (MEA Class EA) to begin the process to upgrade and/or expand the existing water and sewage treatment systems since they are operating at almost 80% (sewage) and 98% (water).

4. The Municipality should consider applying for grants to undertake investigations into the programs identified in Bullets 1 and 2 above. This may include grant applications to complete a MEA Class EA.

Should you have any questions about our proposed work plan, please do not hesitate to contact the undersigned.

Sincerely,

TULLOCH Engineering Inc.

Chris Stilwell, P. Eng.
Project Manager / Principal
chris.stilwell@tulloch.ca

Temagami N WTP

Year	Maximum Flow (m^3/day)	Maximum Flow w/o incident (m^3/day)	Average Day Flow (m^3/day)	Notes
2020	**533**	329	212	Max flow of 533 due to watermain break
2021	473	**383**	196	Max flow of 473 due to watermain break
2022	303	N/A	154	
2023	367	281	150	Max flow of 367 due when HLPs left off
2024	385	276	155	Max flow of 385 due to service break + flushing

Cu = Cr - ([L x F x P]/ H)
Cu = -205 - ([40 x 1.27 x 300] / 189)
Cu = -205 - (15,240 / 189)
Cu = -205 - 80.6
Cu = -285.6

Cr = hydraulic reserve capacity = design capacity minus the recorded maximum day flow
Cr = 328 m3/day (design cap. from MDWL) – 533 m3/day (max. flow from the last 5 years)
Cr = -205 m3/day

L = No. of unconnected approved lots = 40

F = maximum day flow per capita / serviced population
F = **533** / 300 (population from OCWA's records; municipality may need to update)
F = 1.77 m3/day

Note: Lower max day flows can be used if data indicates that the highest flows occurred during an isolated incident. The calculation below uses the maximum day flow during normal operations (without incident such as a watermain breaks).

F = maximum day flow (without isolated incident) / serviced population
F = **383** / 300 (from OCWA's records)
F = 1.27 m3/day

P = existing connected population = 300

H = number of households or residential connections = 189 connections (based on municipality)

Temagami N Lagoon

Year	Average Flow (m^3/day)	Maximum Flow (m^3/day)	Notes
2020	387	1278	
2021	324	1473	
2022	248	1563	
2023	265	1201	
2024	298	1479	
Average	**304**	**1563**	

Cu = Cr-([L x F x P]/ H)

Cu = 86 - ([40 x 1.01 x 300] / 189)
Cu = 86 - (12,120 / 189)
Cu = 86 - 64.1
Cu = 21.9

Cr = hydraulic reserve capacity = design capacity minus the recorded average day flow
Cr = 390 m3/day (design cap. from ECA) – 304 m3/day (avg. flow from the last 5 years)
Cr = 86 m3/day

L = No. of unconnected approved lots = 40

F = average day flow per capita
F = 304 m3/day
F = 304 / 300 (same population as used in the water calc. above)
F = 1.01

P = existing connected population = 300

H = number of households or residential connections = 189 connections (based on municipality)

D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants

Guide for calculating and reporting uncommitted reserve capacity at sewage and water treatment plants.

(formerly appendix A)

Last Revision
March 1995

Rationale (1.0)

It is the position of the Province that the number of lots in approved plans of subdivisions, developments committed by virtue of approved zoning, new official plans or site-specific official plan amendments, should not exceed the design capacity of the sewage and/or water system. In order to ensure that capacity is not exceeded it is necessary to determine what uncommitted reserve capacity is available. This procedure provides a means for determining uncommitted reserve capacity. As noted in Section 2.2.2 of the implementation guideline, if a municipality brings forward a specific proposal for alternative approaches for calculating and reporting uncommitted reserve capacity, the Ministry of Environment and Energy (MOEE) Regional Office will consider entering into alternative arrangements with the municipality.

Prior to calculating the uncommitted reserve capacity, it is important to recognize other factors which may limit new development, such as:

- limitations to the sewage collection/pumping stations (i.e.: basement floodings, overflow conditions, etc.);

- limitations to the water distribution system (i.e.: low pressure caused by small diameter mains), and other factors.

To this end, the "owner" is responsible for ensuring these factors, as well as any of the relevant plant performance characteristics listed in Section 3.2 below, are considered before calculating uncommitted reserve capacity for water and sewage works[1].

Plant performance and hydraulic capacity should be closely related to municipal growth management objectives in order to produce environmentally sound decisions regarding servicing. Municipalities should recognize that plant expansion or upgrades typically require a minimum of 3 to 5 years to develop, and should therefore plan for their long term development needs accordingly.

Municipalities should not recommend approval, and approval authorities should not consider approval, for development proposals if the uncommitted reserve capacity calculation has not been prepared and submitted according to the principles set out in this document. Furthermore, if other factors which limit plant performance are not identified and addressed the application must be considered incomplete. MOEE is not able to process incomplete applications.

Role of the ministry of environment and energy (2.0)

MOEE, as the regulatory agency, is responsible for facilitating and promoting the compliance with the *Environmental Protection Act*, the *Ontario Water Resources Act*, and regulations enacted under those statutes. This mandate is fulfilled in part, through the issuance of Certificates of Approval, and based upon Ministry policies and guidelines. To this end, favourable comments from the MOEE on development proposals as they concern water and sewage treatment facilities, are contingent upon sufficient uncommitted hydraulic capacity and plant performance that is environmentally acceptable.

Calculating uncommitted reserve capacity for sewage and water treatment facilities (3.0)

In determining the uncommitted reserve capacity of sewage and water treatment plants, the following factors need to be considered: hydraulic capacity and plant performance in relation to environmental protection as set out in Ministry statutes, regulations and policies, and; the Certificate of Approval. Each of these matters must be considered by both the Municipality and the MOEE in assessing whether development proposals should be entertained.

Hydraulic Capacity (3.1)

The uncommitted reserve hydraulic capacity should be calculated using the following formula:

$Cu = Cr - ([L \times F \times P] \div H)$

Where:

Cu
uncommitted hydraulic reserve capacity (m^3/d)

Cr
hydraulic reserve capacity (m^3/d)

L
number of unconnected approved lots

P
existing connected population

H
number of households or residential connections

F
Defined under Sewage Treatment Plants: average day flow per capita ($m^3/capita/d$)

Defined under Water Treatment Plants: maximum daily flow per capita ($m^3/capita/d$)

Please refer to the definitions provided in Section 6.0 to assist you with this calculation.

Note 1: The Formula accounts for industrial, commercial, institutional and other flows by means of the per capita flow figure which includes flows from all types of land uses and other flow sources such as infiltration. In certain cases, such as where there is evidence of seasonal population fluctuations, rapid growth and/or the existence of large industries, or in cases where per capita water or sewage flows for proposed new developments will be substantially different from historical flows, etc., the Regional MOEE Director may consider it reasonable and appropriate to modify the manner in which the calculation is completed. Municipalities are advised to consult their Regional MOEE office in this regard.

In order to provide additional protection against the design capacity of the systems being overcommitted, municipalities may choose to apply separate allocations for uses such as industrial plans of subdivisions, site-specific industrial uses characterized by high water consumption, existing vacant residential lots and similar examples that could significantly reduce the calculated reserve capacity by increasing the per capita flow figure.

Note 2: In calculating the uncommitted hydraulic reserve capacity, municipalities should ensure that the variable "L" represents all unconnected servicing commitments including:

- vacant lots/units in registered plans of subdivision and condominium
- lots/units in draft approved plans of subdivision/condominium;
- the maximum development potential of lands (i.e. scale and density) as permitted under existing zoning;
- registered plans of condominium;
- vacant lots created by consent in serviced areas.

Note 3: For Water Treatment Plants:

Maximum day flows to be subtracted from uncommitted reserve capacity should be calculated on the basis of those increased max day flows at the treatment plant as opposed to a max day flow calculated for the development. The latter would be an unrealistic representation of the impact of a small development at the treatment plant in a large community.

The following are examples of calculations for sewage and water treatment plants, using the above formula:

For Sewage Treatment Plant

- Cr = 12,000 m^3/day
- L = 3,000 lots
- F = .45 m^3/day
- P = 25,000 people
- H = 8,000

Cu = Cr − [L × F × P] ÷ H
Cu = 12000 − (3000 × .45 × 25000) ÷ 8000
= 7,781.25 m^3/day

For Water Treatment Plant

- Cr = 20,000 m^3/d
- L = 3,000 lots
- F = 0.9 m^3/d
- P = 25,000 people
- H = 8,000

Cu = Cr − [L × F × P] ÷ H
Cu = 20000 − [3000 × .9 × 25000] ÷ 8000
= 11562.5 m^3/d

Plant Performance Characteristics Which May Affect the Use of the Above Formula (3.2)

For Sewage Treatment Plants

The following performance characteristics may be used as a basis for imposing limited or long term development constraints:

- the treatment facility is in poor condition, performing erratically or not in accordance with its design;
- the effluent quality parameters exceed or are near the limits specified in the plant's Certificate of Approval;

- the sewage strength (i.e. organic loading) varies significantly due to industrial discharges into municipal sewers.

For Water Treatment Plants

The following performance characteristics may be used as a basis for imposing limited or long term development constraints:

- the existing treatment facility is in poor condition and not capable in meeting the maximum day demands, limiting pressures, etc.
- existing water quality does not meet health related parameters of the Ontario Drinking Water Objectives as stipulated in the plant's Certificate of Approval;

Compliance with Certificate of Approval (3.3)

Municipalities are responsible for ensuring that they are incompliance with Environmental Laws and the Certificates of Approval issued for their plants. Certificates of Approval typically identify effluent limits which must be met. Noncompliance for effluent quality must limit development in the same way as insufficient hydraulic capacity.

Typical examples of limiting factors established in Certificates of Approval for sewage works which must be complied with are: biochemical oxygen demand (BOD), suspended solids and phosphorus.

In many cases the Certificates of Approval also specify additional parameters which require monitoring (e.g., ammonia) depending on plant process. As a result, it is of critical importance that municipalities be aware of the specific requirements of their certificates. If the Certificate of Approval specifies a sampling protocol, it must be followed. If not, please refer to the MOEE policy entitled "Policy to Govern Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only)" (MOEE Policy 08-06).

Policies of the Ministry of Environment and Energy (3.4)

In addition to the requirements of the Certificate of Approval, there are a number of MOEE policies that govern the operation of treatment facilities (e.g. Ontario Drinking Water Objectives, Treatment Requirements for Municipal and Communal Water Works Using Ground Water Sources). This Ministry recommends that these policies be followed. Failure to comply with these policies may result in development restrictions imposed by this

Ministry. Please refer to the addendum for a listing of the policies. For copies of these policies please contact the nearest MOEE Regional or District Office.

Annual report (4.0)

Municipalities should produce an annual report within 90 days of the end of each calendar year, based on the calculation methods set out in this guideline. The annual report should address both hydraulic capacity and performance factors, and be retained by the municipality for a period of three (3) years. Under environmental legislation, these reports must be made available to Ministry personnel upon request.

The annual report must be authorized by an appropriate municipal official.[2] The date of the first annual report should be determined in consultation with the MOEE.

Note 4: Review and acceptance of an annual report by the MOEE should not be construed as confirmation of compliance with the requirements of the Certificate of Approval.

Implementation (5.0)

Each development application circulated to the planning authority should be accompanied by written certification, prepared by the appropriate municipal official, which indicates that uncommitted capacity is available and has been allocated to the development.

Explanation of terms used in calculations of hydraulic capacity (6.0)

Sewage Treatment Plants

Design Capacity

The design capacity may be defined in the Design Report or in the Certificate of Approval. The components of the wastewater flow may include:

- domestic wastewater;
- industrial wastewater;
- inflow/infiltration;
- storm water.

Average Daily Per Capita Flow

The average daily per capita flow means the total sewage flow to the sewage works over twelve (12) consecutive calendar months, or during the period of operation upon which the report is based, divided by the number of days during the same period of time. Yearly average day flows are acceptable if the effluent compliance criteria for the defined parameters is based on average yearly concentration and loading limits.

Note 5: The use of 3 vs. 5 year records in establishing representative average daily flows will be determined by the MOEE Regional Director.

Hydraulic Reserve Capacity

The hydraulic reserve capacity is defined as the design capacity minus the actual existing recorded average day flow.

Uncommitted Hydraulic Reserve Capacity

The uncommitted hydraulic reserve capacity is obtained by subtracting the previously committed flows of registered and draft approved residential, commercial and industrial lots, from the existing hydraulic reserve capacity.

Commercial/Industrial Lots

Sewage flows for commercial/industrial lots must be determined by the municipality. Municipalities should do this by estimating the water consumption/sewage figures for similarly sized, similar type developments and factor this information into the calculation of the uncommitted reserve capacity. Moreover, it should be understood that in some cases organic loading, and not hydraulic loading, may be the limiting factor.

In exceptional circumstances it is not possible to estimate water consumption/sewage figures, municipalities may estimate the flow with the prior approval of the Ministry. If the Ministry agrees that this is acceptable in the specific situation, the following approach may be used:

Industrial/institutional/commercial flows can be equated to an equivalent residential flow. A production/consumption rate of 100 gallons or 450 litres per capita per day of sewage flow or water demand should be used for designing sewage plants. This number will vary according to municipality. Once specific industry is identified, the municipality will have a better indication of the amount of water the industry requires or the amount of sewage flows produced. The municipality will be able to determine whether its present sewage works can accommodate the industry.

Draft Approval

Draft approved lots/units are those lots granted approval subject to certain conditions. These conditions must be fulfilled before the lots can receive final approval.
Draft approval is a commitment on behalf of the province and the municipality, and is interpreted by the proponent and the public as a reasonable assurance that development can proceed. Within a serviced municipality, the Province considers capacity to be committed to a development when draft approval is granted.

Water Treatment Plants

Design Capacity

Design capacity of water treatment plants is defined as quantity of water which can be delivered to the distribution system when operating the plant under design conditions and is sufficient to meet the maximum day demand. (Greater capacities may be required depending on in-system fire flow requirements and storage capacity). The design capacity of water treatment plants can be obtained from the Certificate of Approval, Water Taking Permit, the design documents or design/operating manuals.

Hydraulic Reserve Capacity

The hydraulic reserve capacity is defined as the design capacity minus the actual existing recorded maximum day flow. In some instances, the capacity of ground water supply wells or the perennial yield of the aquifer must be determined in order to calculate the hydraulic reserve capacity for municipalities provided by such ground water supply systems.

Uncommitted Hydraulic Reserve Capacity:

The uncommitted hydraulic reserve capacity is obtained by subtracting the equivalent flow commitments to registered and draft approved residential, commercial and industrial lots from the existing hydraulic reserve capacity.

Commercial/Industrial Lots

Water consumption for commercial/industrial lots must be determined by the municipality. Water demands for commercial/industrial establishments vary greatly with the type of water-using facilities present in the development, the number of people using it etc. Industrial water demands will vary greatly with the type of industry i.e. wet or dry operations.

In exceptional circumstances, municipalities may estimate the flow with the prior approval of the Ministry.

Draft Approval
Draft approved lots/units are those lots granted approval subject to certain conditions. These conditions must be fulfilled before the lots can receive final approval.
Draft approval is a commitment on behalf of the province and the municipality, and is interpreted by the proponent and the public as a reasonable assurance that development can proceed. Within a serviced municipality, the Province considers capacity to be committed to a development when draft approval is granted.

Maximum Day Per Capita Flow
The maximum day per capita flow is based on the existing maximum day flow divided by the serviced population. Lower maximum day flow figures may be accepted if the data indicates the highest flow(s) to the system occurred on an isolated basis, or where the municipality has successfully attempted to reduce leakage from the system and has also installed flow reducing devices.
As an alternative, the maximum day flow per capita may be derived by multiplying the average daily per capita flow with the maximum day factor. The maximum day factor is available in the design report or determined by using the design manual.

Note 6: The use of 3 vs. 5 year records in establishing representative maximum day flow will be determined by the MOEE Regional Director.

Addendum

Listing of ministry of the environment and energy policies governing the operation of treatment facilities

Guideline B-1:
Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment

Guideline B-13:
Treatment Requirements for Municipal and Communal Water Works Using Surface Water Sources

Guideline B-14:
Treatment Requirements for Municipal and Communal Water Works Using Ground Water Sources

Guideline B-15:
Use of Pesticides In and Around Water Works

Guideline F-5:
Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters

Guideline F-7:
Minimum Accepted Level of Servicing for Municipally and Privately Owned Communal Systems

Procedure F-8-1:
Policy to Govern the Provision and Operation of Phosphorus Removal Facilities at Municipal, Institutional and Private Sewage Treatment Works

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[1] The "owner" refers to the legal owner of the facility, or the person designated as owner in the Certificate of Approval for the works.

[2] "Appropriate municipal official" should be someone with credentials qualifying him/her to certify the capacity calculation as being a true and accurate reflection of the status of the sewage and water works. In an organized municipality, this would most likely refer to either the CEO or the Clerk.

Updated: July 13, 2021
Published: April 14, 2016

APPENDIX B

Existing Drinking Water System Layout Drawing (WM1)

REVISION:	No.	DATE	BY
ISSUED FOR REVIEW	1	MAR. 24, 2025	SW
-	-	-	-
-	-	-	-
-	-	-	-

ENGINEER'S SEAL

TULLOCH

COMMUNITY OF TEMAGAMI NORTH
WATER STORAGE EVALUATION

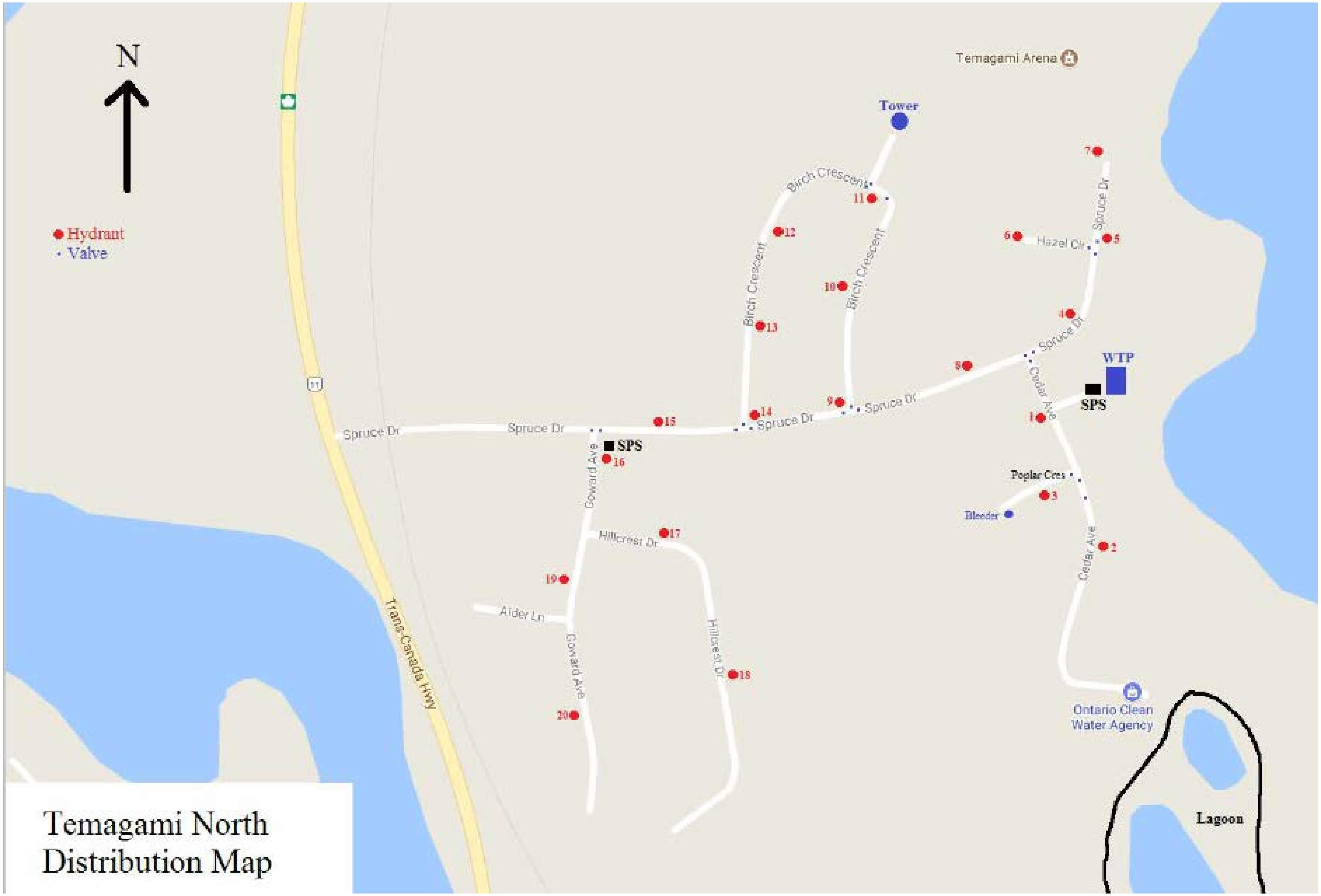
WATER SYSTEM LAYOUT

SW	BB/SW	BB	CS
DRAWN	DESIGNED	CHECKED	APPROVED
1:1,500		MARCH 24, 2025	
SCALE		DATE	
241337	1	WM1	
PROJECT No.	REVISION	DRAWING	

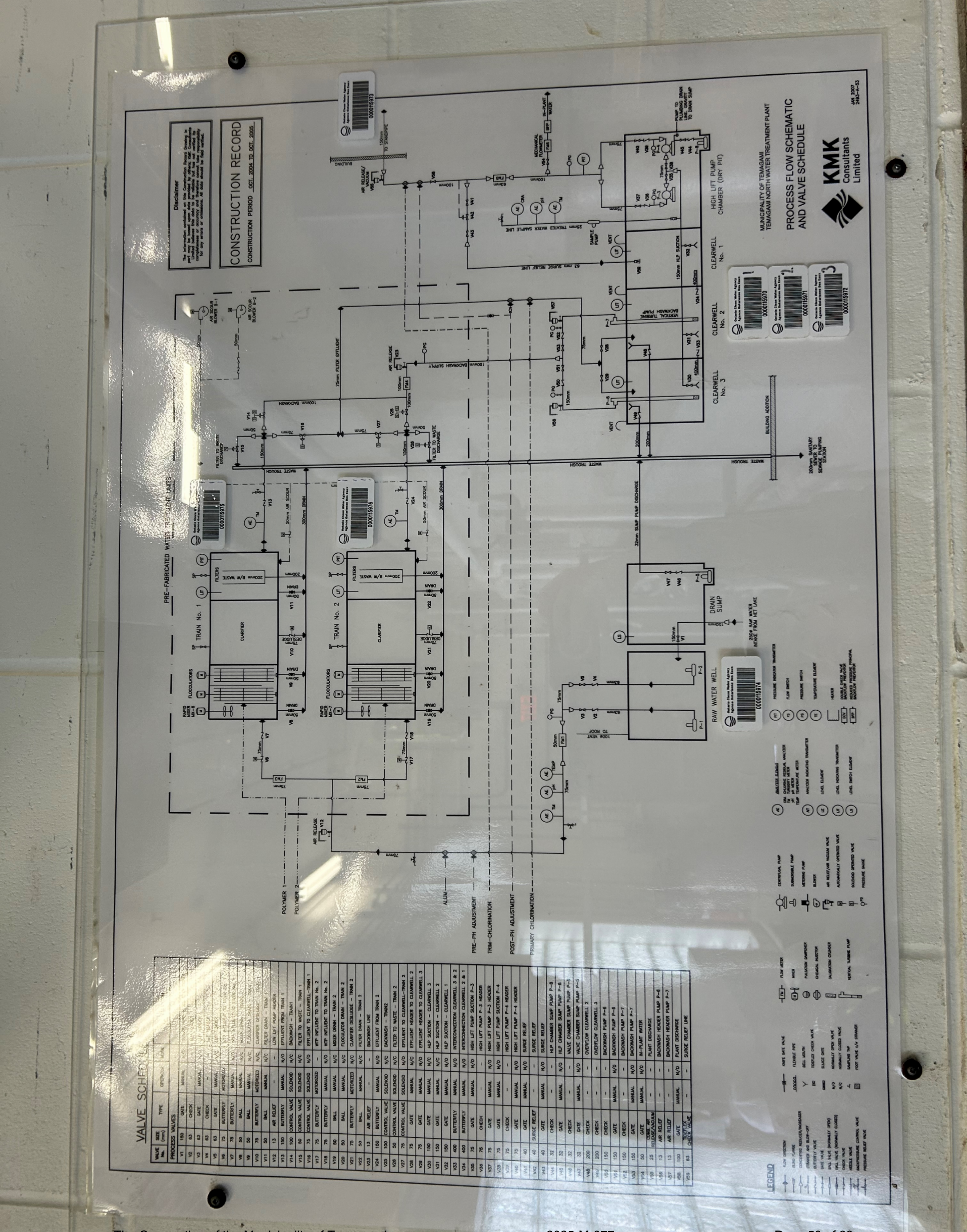
C:\Users\sean.wetmore\Desktop\Active Projects\241337 Temagami WM\241337_Spruce Drive, Temagami_WM Layout_Jan 6, 2025.dwg

APPENDIX C

Schematic Diagram of Water Treatment Plant & Water Distribution System



Temagami North Distribution Map


CONSTRUCTION RECORD
CONSTRUCTION PERIOD OCT. 2004 TO OCT. 2005
Disclaimer
PRE-FABRICATED WATER TREATMENT UNITS
TRAIN No. 1
TRAIN No. 2
CLARIFIER
FILTERS
RAW WATER WELL
DRAIN SUMP
CLEARWELL No. 1
CLEARWELL No. 2
CLEARWELL No. 3
HIGH LIFT PUMP CHAMBER (DRY PIT)
WASTE TROUGH
BUILDING ADDITION
POLYMER 1
POLYMER 2
ALUM
PRE-PH ADJUSTMENT
TRIM-CHLORINATION
POST-PH ADJUSTMENT
PRIMARY CHLORINATION
VALVE SCHEDULE
LEGEND
MUNICIPALITY OF TEMAGAMI
TEMAGAMI NORTH WATER TREATMENT PLANT
PROCESS FLOW SCHEMATIC AND VALVE SCHEDULE
KMK Consultants Limited
JAN 2007

APPENDIX D

Hydrant Flow Test Results

WATER FLOW TEST REPORT NO.1

TULLOCH ENGINEERING

PROJECT #:	241137			
DATE (dd/mm/yr):	28/11/2024			
TIME OF DAY:			TEST BY:	M. Stevens
WEATHER:			CHECKED BY:	B. Belfry

TEST LOCATION: Birch Crescent, Temagami North ON

WATER SUPPLIED BY: ☑ MUNICIPAL SYSTEM ☐ PRIVATE SYSTEM ☐ WELL ☐ Unknown

TEST TYPE: ☑ FIRE FLOW ☑ WATERMAIN CAPACITY ☐ HYDRANT CAPACITY

MAIN DIAMETER: ☐ 4 in. or less ☑ 6 in. ☑ 8 in. ☐ 10" ☐ 12" ☐ 16" or larger ☐ Unknown

PIPE MATERIAL ☑ PVC ☐ DUCTILE IRON ☑ CAST IRON ☑ Unknown

DATA

STATIC/RESIDUAL HYDRANT # ***10***
(input analysis hydrant identification)

FLOW HYDRANT(S)	***9***		*(input hydrant identification)*
PITOT ORAFICE DIA. (in.):	2.00		
COEFFICIENT:	1.310		
PITOT READING (psi):	6		
USGPM:	383	0	

TOTAL FLOW DURING TEST: **383** **USGPM**

STATIC READING: **34** **PSI** At analysis hydrant
RESIDUAL READING: **16** **PSI**

RESULTS:	***AT 20 PSI RESIDUAL***	**334**	**USGPM**	***AT 0 PSI***	**540**	**USGPM**

DURATION OF FLOW TEST (minutes):
ESTIMATED CONSUMPTION: 0 USGAL.

REMARKS: No Pump Operating

☐ Test meets requirements of NFPA 291 ☐ Test achieves 10% practical pressure drop
☐ Test accuracy diminished due to inability to obtain satisfactory drop in system pressure

WATER FLOW TEST REPORT NO. 2

PROJECT #:	241137
DATE (dd/mm/yr):	28/11/2024
TIME OF DAY:	
WEATHER:	
TEST BY:	M. Stevens
CHECKED BY:	B. Belfry

TEST LOCATION: Goward Avenue, Temagami North ON

WATER SUPPLIED BY: ☑ MUNICIPAL SYSTEM ☐ PRIVATE SYSTEM ☐ WELL ☐ Unknown

TEST TYPE: ☑ FIRE FLOW ☑ WATERMAIN CAPACITY ☐ HYDRANT CAPACITY

MAIN DIAMETER: ☐ 4 in. or less ☑ 6 in. ☑ 8 in. ☐ 10" ☐ 12" ☐ 16" or larger ☐ Unknown

PIPE MATERIAL ☑ PVC ☐ DUCTILE IRON ☑ CAST IRON ☑ Unknown

DATA

STATIC/RESIDUAL HYDRANT # ***19***

(input analysis hydrant identification)

FLOW HYDRANT(S)	***20***		*(input hydrant identification)*
PITOT ORAFICE DIA. (in.):	2.00		
COEFFICIENT:	1.310		
PITOT READING (psi):	6.2		
USGPM:	389	0	

TOTAL FLOW DURING TEST: **389** **USGPM**

STATIC READING: **46** **PSI** At analysis hydrant

RESIDUAL READING: **13** **PSI**

RESULTS:	***AT 20 PSI RESIDUAL***	**342**	**USGPM**	***AT 0 PSI***	**466**	**USGPM**

DURATION OF FLOW TEST (minutes):

ESTIMATED CONSUMPTION: 0 USGAL.

REMARKS: No Pump Operating

☐ Test meets requirements of NFPA 291 ☐ Test achieves 10% practical pressure drop

☐ Test accuracy diminished due to inability to obtain satisfactory drop in system pressure

WATER FLOW TEST REPORT NO. 3

PROJECT #: 241137
DATE (dd/mm/yr): 28/11/2024
TIME OF DAY:
WEATHER:

TEST BY: M. Stevens
CHECKED BY: B. Belfry

TEST LOCATION: Poplar Crescent, Temagami North ON
WATER SUPPLIED BY: ☑ MUNICIPAL SYSTEM ☐ PRIVATE SYSTEM ☐ WELL ☐ Unknown
TEST TYPE: ☑ FIRE FLOW ☑ WATERMAIN CAPACITY ☐ HYDRANT CAPACITY
MAIN DIAMETER: ☐ 4 in. or less ☑ 6 in. ☑ 8 in. ☐ 10" ☐ 12" ☐ 16" or larger ☐ Unknown
PIPE MATERIAL ☑ PVC ☐ DUCTILE IRON ☑ CAST IRON ☑ Unknown

DATA

STATIC/RESIDUAL HYDRANT # ***3***
(input analysis hydrant identification)

FLOW HYDRANT(S)	***28***	*(input hydrant identification)*
PITOT ORAFICE DIA. (in.):	2.00	
COEFFICIENT:	1.310	
PITOT READING (psi):	5.2	
USGPM:	356	0

TOTAL FLOW DURING TEST: **356** **USGPM**

STATIC READING: **46** **PSI** At analysis hydrant
RESIDUAL READING: **13** **PSI**

RESULTS:	***AT 20 PSI RESIDUAL***	**313**	**USGPM**	***AT 0 PSI***	**426**	**USGPM**

DURATION OF FLOW TEST (minutes):
ESTIMATED CONSUMPTION: 0 USGAL.

REMARKS: No Pump Operating

☐ Test meets requirements of NFPA 291 ☐ Test achieves 10% practical pressure drop
☐ Test accuracy diminished due to inability to obtain satisfactory drop in system pressure

WATER FLOW TEST REPORT NO. 4

TULLOCH ENGINEERING

PROJECT #:	241137
DATE (dd/mm/yr):	28/11/2024
TIME OF DAY:	
WEATHER:	

TEST BY: M. Stevens
CHECKED BY: B. Belfry

TEST LOCATION: Poplar Crescent, Temagami North ON

WATER SUPPLIED BY: ☑ MUNICIPAL SYSTEM ☐ PRIVATE SYSTEM ☐ WELL ☐ Unknown

TEST TYPE: ☑ FIRE FLOW ☑ WATERMAIN CAPACITY ☐ HYDRANT CAPACITY

MAIN DIAMETER: ☐ 4 in. or less ☑ 6 in. ☑ 8 in. ☐ 10" ☐ 12" ☐ 16" or larger ☐ Unknown

PIPE MATERIAL ☑ PVC ☐ DUCTILE IRON ☑ CAST IRON ☑ Unknown

DATA

STATIC/RESIDUAL HYDRANT # ***3***
(input analysis hydrant identification)

FLOW HYDRANT(S)	***28***		*(input hydrant identification)*
PITOT ORAFICE DIA. (in.):	2.00		
COEFFICIENT:	1.310		
PITOT READING (psi):	7.8		
USGPM:	437	0	

TOTAL FLOW DURING TEST: **437** **USGPM**

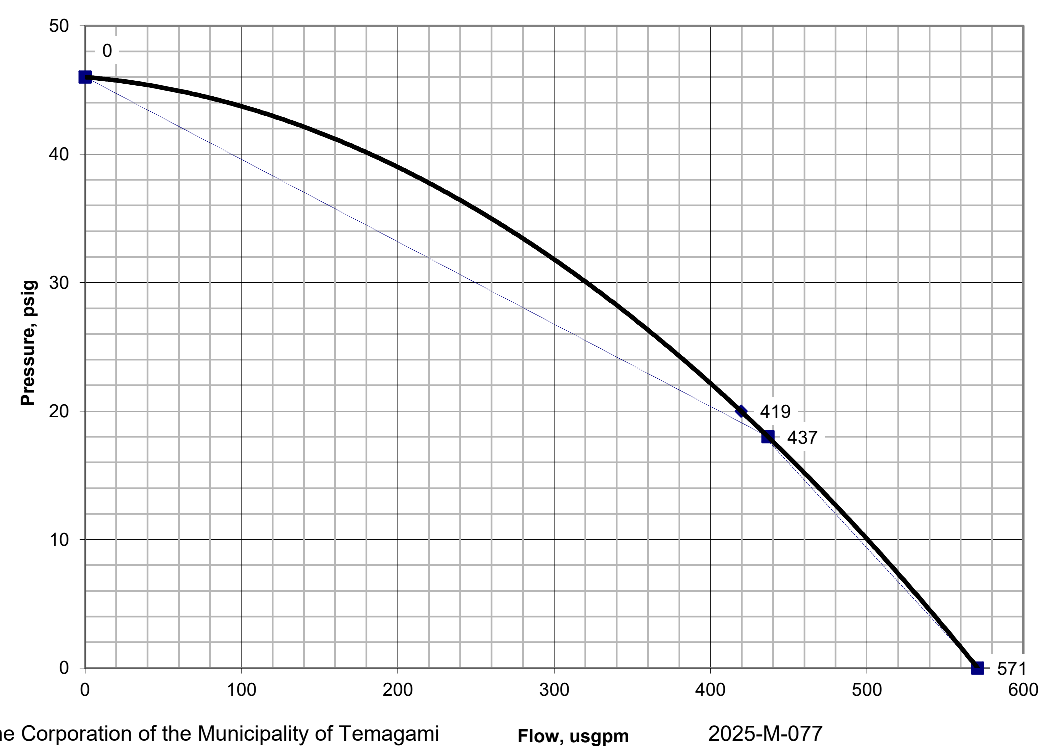
STATIC READING: **46** **PSI** At analysis hydrant
RESIDUAL READING: **18** **PSI**

RESULTS:	***AT 20 PSI RESIDUAL***	**419**	**USGPM**	***AT 0 PSI***	**571**	**USGPM**

DURATION OF FLOW TEST (minutes):
ESTIMATED CONSUMPTION: 0 USGAL.

REMARKS: 1 High Lift Pump Operating

☐ Test meets requirements of NFPA 291 ☐ Test achieves 10% practical pressure drop
☐ Test accuracy diminished due to inability to obtain satisfactory drop in system pressure



APPENDIX E

Tabulated Node Demands – WM2

TULLOCH	Project:	Temagami North Water Storage Improvements	Date:	24-Mar-25	WM2
	File No:	24-1337	Designed:	BB	
	Subject:	Watermain Node Demands	Checked:	CS	
	Average Day Demand, Maximum Day Demand, Peak Hour Demand, and Maximum Day Demand with Fire Flow				

Domestic Flow	578	L/Cap/D	From MECP Design Guidelines-2008
People/Unit	1.59		Normal pressure is 350kPa to 480 kPa under maximum day demand conditions (50-70 psi)
Unit Count	189		
Max Day Peaking Factor	1.83		Minimum pressure is 275 kPa (40 psi) under maximum day demand conditions
Peak Hour Peaking Factor	5.4		
Max Day Flow Rate	3.679	L/s	Minimum presssure under max day demand plus fire flow is 138 kPa (20 psi)
Fire Flow Demand (MECP)	38.000	L/s	
Fire Flow Demand (Fire Underwriter's Survey)	67.000	L/s	
Fire Flow Demand (Temagami Fire Dept.)	41.000	L/s	
Design Flow (Peak Hour)	10.856	L/s	Maximum pressure is 700 kPa (100 psi)
Design Flow (Max Day + Fire)	70.679	L/s	Pressure below "Normal"
Average Day Flow Rate	2.010	L/s	Pressure exceeds maximum
			Pressure below minimum

Maximum Day Plus Fire Flow is greater than Peak Hour Flow.
Therefore use the max day plus fire flow during assessment.

Node Identifier	Node Elevations (m)	Residential Units (ERU)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand Plus Fire Flow of 67 L/s at JU30 (L/s)	Maximum Day Demand Plus Fire Flow of 38 L/s at JU30 (L/s)	Maximum Day Demand Plus Fire Flow of 41 L/s at JU7 (L/s)
JU1	298.65	1	0.011	0.019	0.057	0.019	0.019	0.019
JU2	298.28	4	0.043	0.078	0.230	0.078	0.078	0.078
JU3	299.09	2	0.021	0.039	0.115	0.039	0.039	0.039
JU4	298.36	5	0.053	0.097	0.287	0.097	0.097	0.097
JU5	298.2	6	0.064	0.117	0.345	0.117	0.117	0.117
JU6	299.92	6	0.064	0.117	0.345	0.117	0.117	0.117
JU7	298.36	65	0.691	1.265	3.734	1.265	1.265	42.265
JU8	300.04	5	0.053	0.097	0.287	0.097	0.097	0.097
JU9	303.47	7	0.074	0.136	0.402	0.136	0.136	0.136
JU10	309.72	9	0.096	0.175	0.517	0.175	0.175	0.175
JU11	312.96	0	0.000	0.000	0.000	0.000	0.000	0.000
JU12	307.22	5	0.053	0.097	0.287	0.097	0.097	0.097
JU13	304.06	8	0.085	0.156	0.460	0.156	0.156	0.156
JU14	303.24	4	0.043	0.078	0.230	0.078	0.078	0.078
JU15	301.31	6	0.064	0.117	0.345	0.117	0.117	0.117
JU16	301.01	0	0.000	0.000	0.000	0.000	0.000	0.000
JU17	306.61	6	0.064	0.117	0.345	0.117	0.117	0.117
JU18	308.91	11	0.117	0.214	0.632	0.214	0.214	0.214
JU19	300.23	3	0.032	0.058	0.172	0.058	0.058	0.058
JU20	301.67	7	0.074	0.136	0.402	0.136	0.136	0.136

TULLOCH	Project:	Temagami North Water Storage Improvements	Date:	24-Mar-25	WM2
	File No:	24-1337	Designed:	BB	
	Subject:	Watermain Node Demands	Checked:	CS	
	Average Day Demand, Maximum Day Demand, Peak Hour Demand, and Maximum Day Demand with Fire Flow				

Domestic Flow	578	L/Cap/D	From MECP Design Guidelines-2008
People/Unit	1.59		Normal pressure is 350kPa to 480 kPa under maximum day demand conditions (50-70 psi)
Unit Count	189		
Max Day Peaking Factor	1.83		Minimum pressure is 275 kPa (40 psi) under maximum day demand conditions
Peak Hour Peaking Factor	5.4		
Max Day Flow Rate	3.679	L/s	Minimum presssure under max day demand plus fire flow is 138 kPa (20 psi)
Fire Flow Demand (MECP)	38.000	L/s	
Fire Flow Demand (Fire Underwriter's Survey)	67.000	L/s	
Fire Flow Demand (Temagami Fire Dept.)	41.000	L/s	
Design Flow (Peak Hour)	10.856	L/s	Maximum pressure is 700 kPa (100 psi)
Design Flow (Max Day + Fire)	70.679	L/s	Pressure below "Normal"
Average Day Flow Rate	2.010	L/s	Pressure exceeds maximum
			Pressure below minimum

Maximum Day Plus Fire Flow is greater than Peak Hour Flow. Therefore use the max day plus fire flow during assessment.

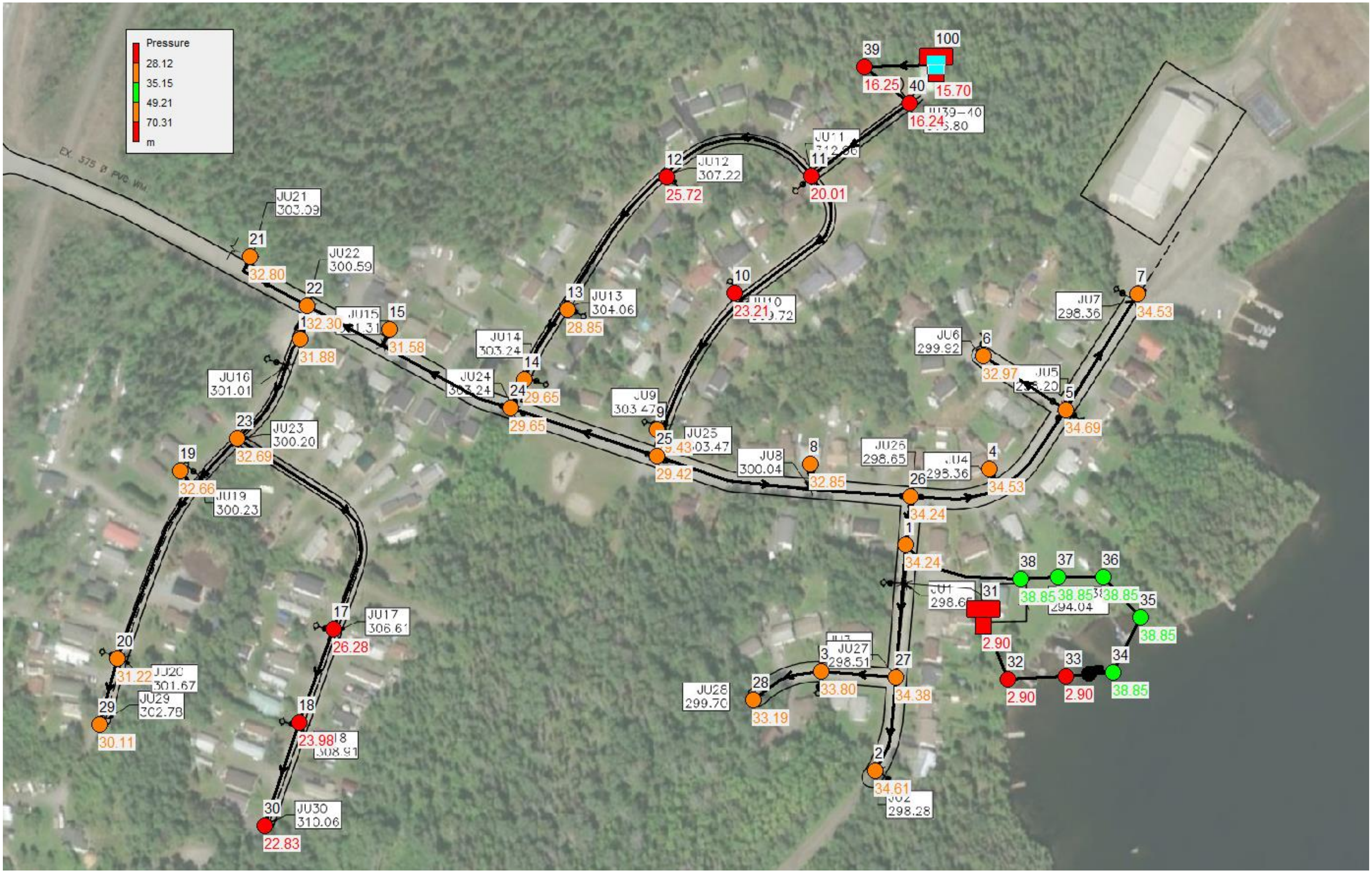
Node Identifier	Node Elevations (m)	Residential Units (ERU)	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand Plus Fire Flow of 67 L/s at JU30 (L/s)	Maximum Day Demand Plus Fire Flow of 38 L/s at JU30 (L/s)	Maximum Day Demand Plus Fire Flow of 41 L/s at JU7 (L/s)
JU21	299.7	0	0.000	0.000	0.000	0.000	0.000	0.000
JU22	300.09	5	0.053	0.097	0.287	0.097	0.097	0.097
JU23	300.59	0	0.000	0.000	0.000	0.000	0.000	0.000
JU24	300.20	0	0.000	0.000	0.000	0.000	0.000	0.000
JU25	303.24	2	0.021	0.039	0.115	0.039	0.039	0.039
JU26	303.47	4	0.043	0.078	0.230	0.078	0.078	0.078
JU27	298.65	4	0.043	0.078	0.230	0.078	0.078	0.078
JU28	298.51	4	0.043	0.078	0.230	0.078	0.078	0.078
JU29	302.78	3	0.032	0.058	0.172	0.058	0.058	0.058
JU30	310.06	7	0.074	0.136	0.402	67.136	38.136	0.136
Tank 31	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU32	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU33	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU34	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU35	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU36	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU37	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU38	294.04	0	0.000	0.000	0.000	0.000	0.000	0.000
JU39	316.80	0	0.000	0.000	0.000	0.000	0.000	0.000
JU40	316.80	0	0.000	0.000	0.000	0.000	0.000	0.000
Tank 100	317.35	0	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		189	2.010	3.679	10.856	70.679	41.679	44.679

APPENDIX F

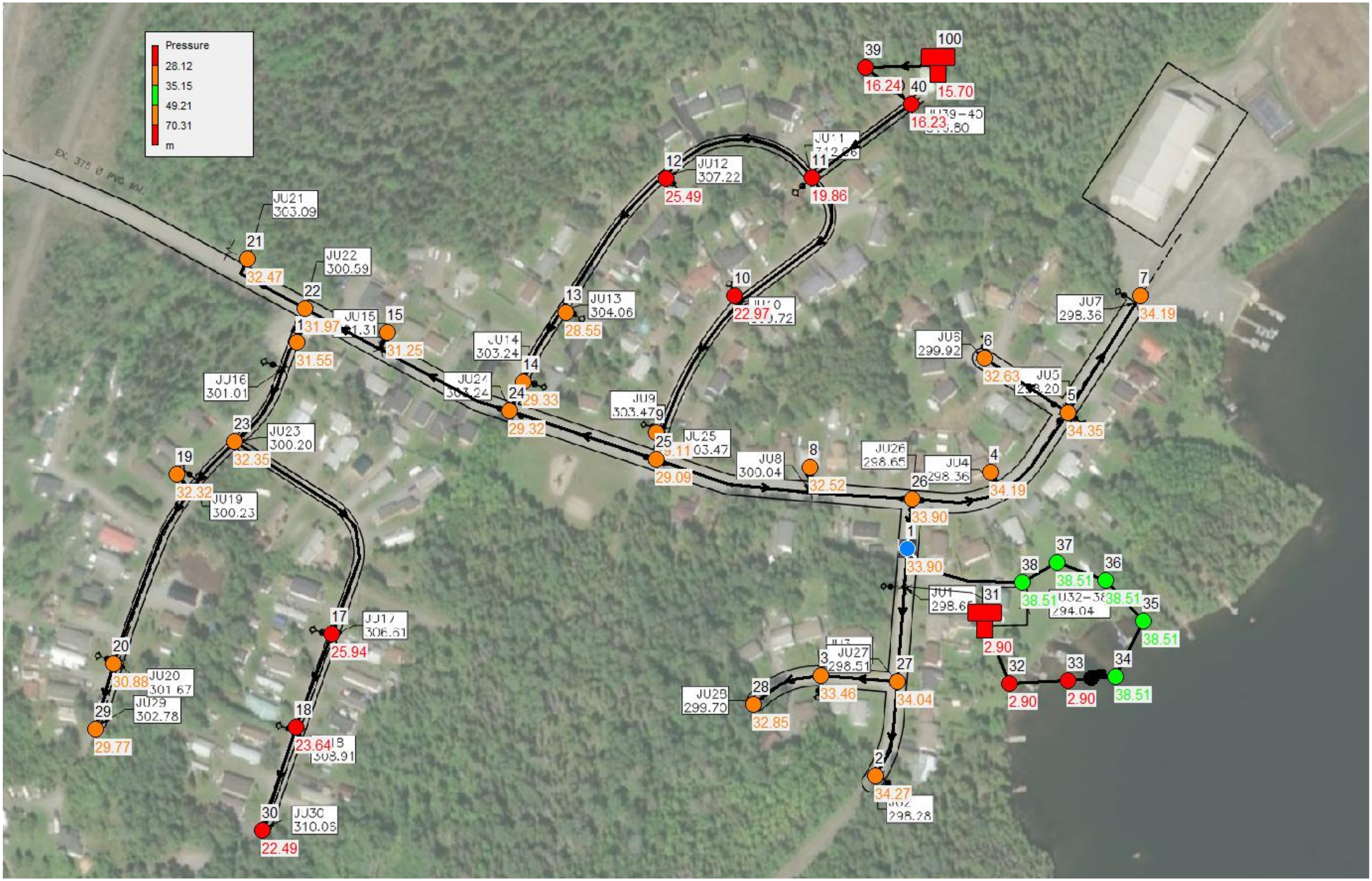
Schematic and Tabulated Node Results – WM3

WM3 - EPA NET 2.0 Schematic Results

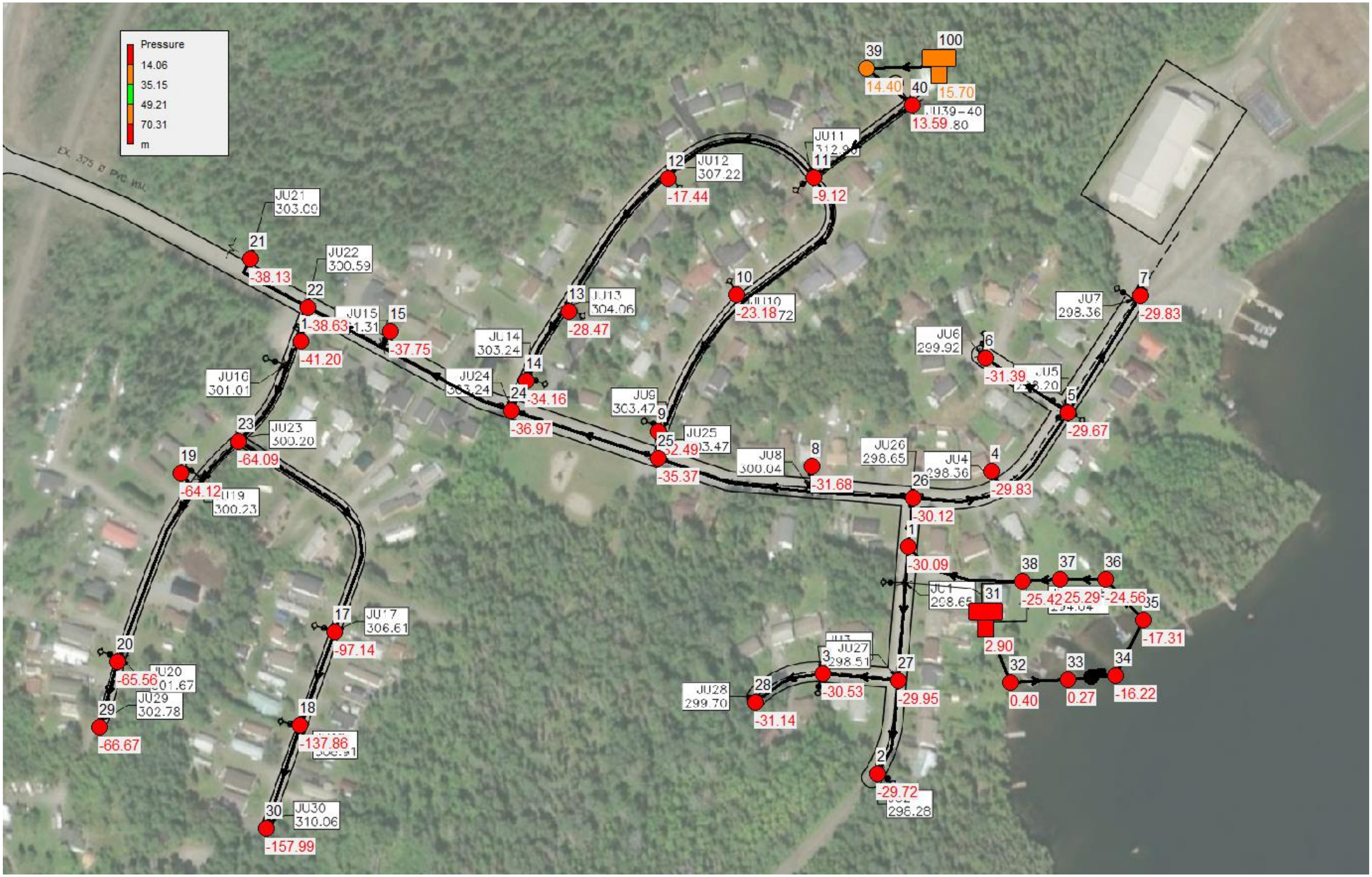
Scenario 1: Existing Conditions Average Day Demand



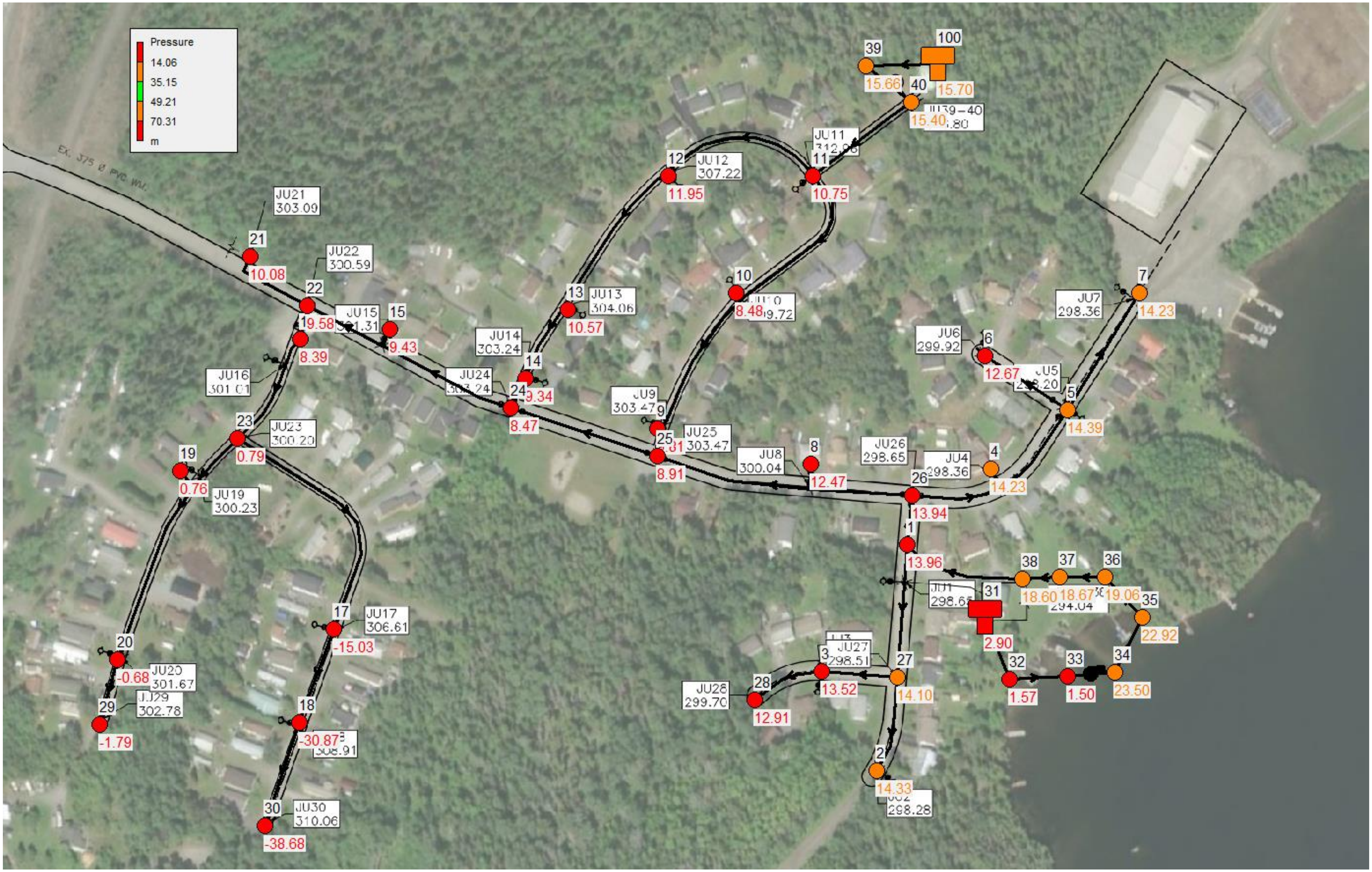
Scenario 2: Existing Conditions Maximum Day Demand



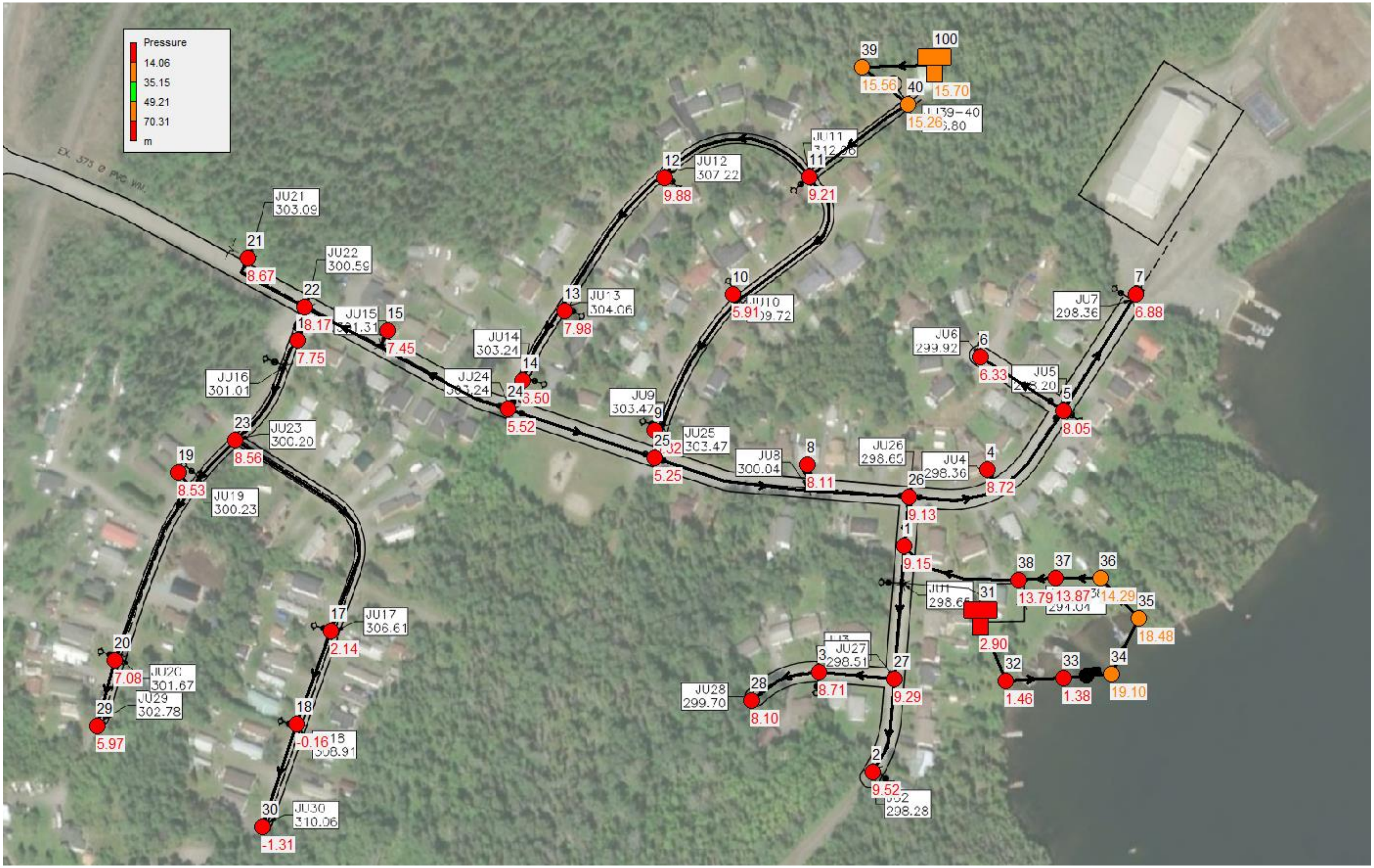
Scenario 3: Existing Conditions Maximum Day Demand Plus 67 L/s Fire Flow at JU30 With High Lift Pump On



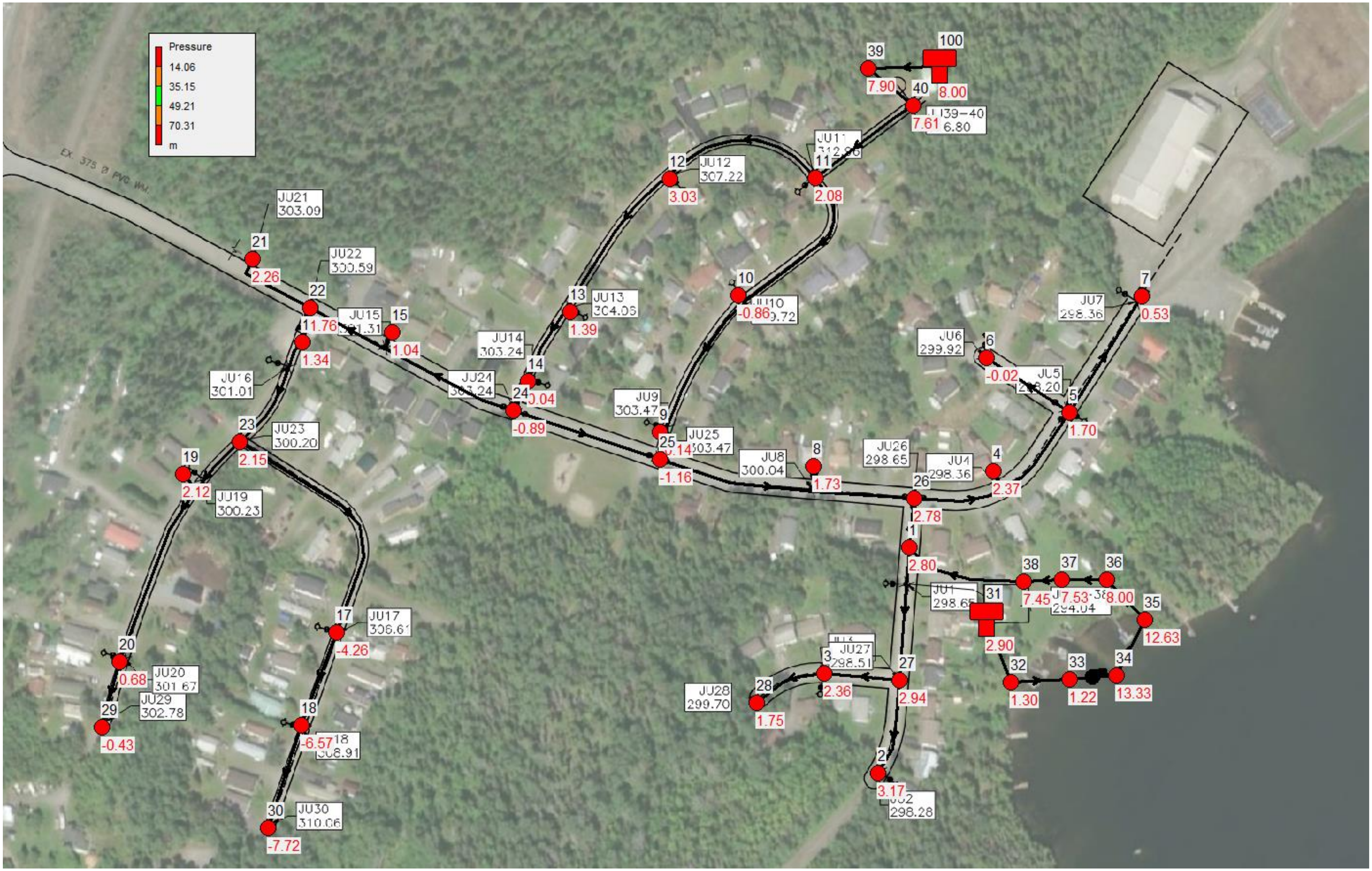
Scenario 4: Existing Conditions Maximum Day Demand Plus 38 L/s Fire Flow at JU30 With High Lift Pump On



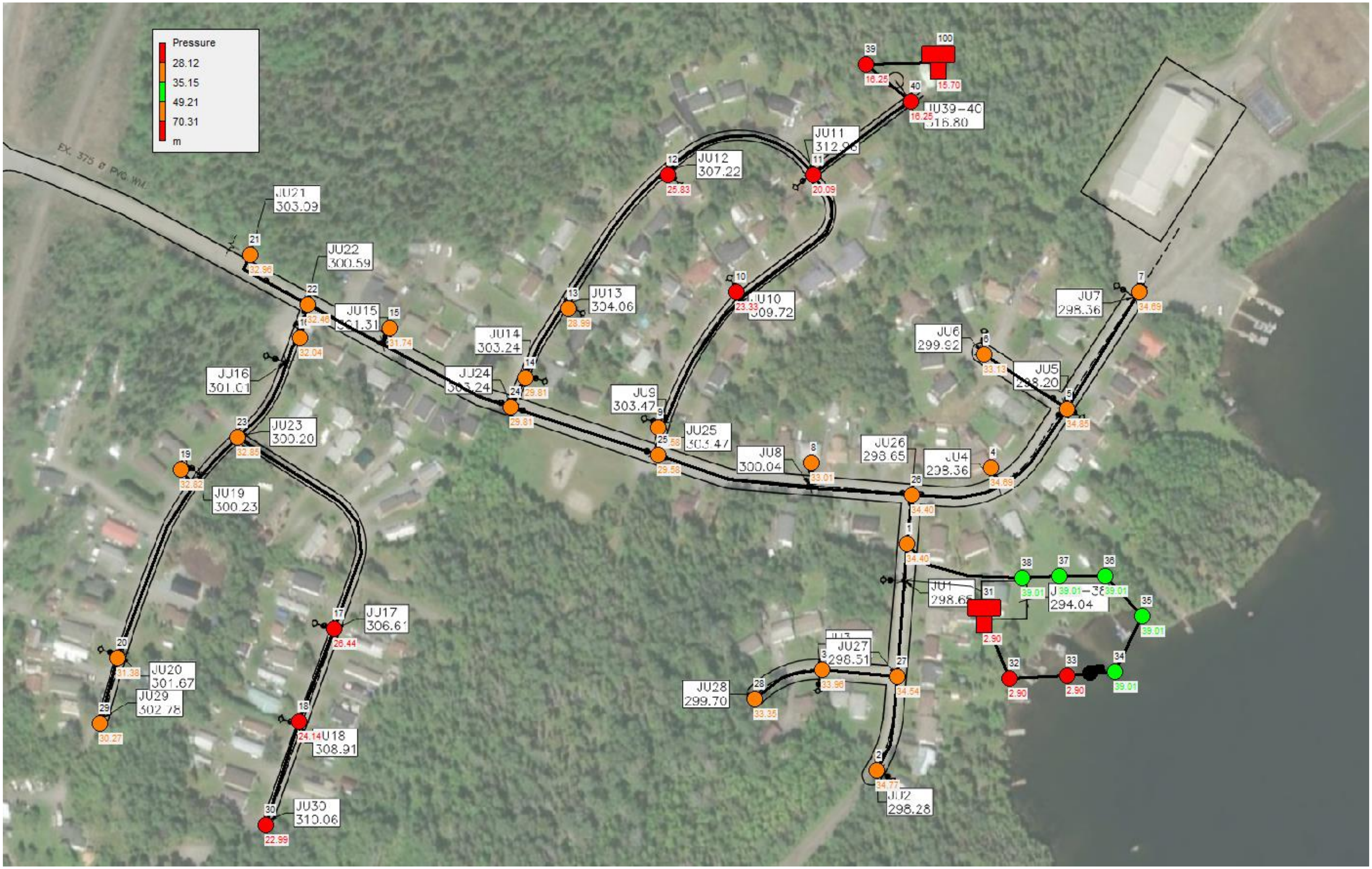
Scenario 5A: Existing Conditions Maximum Day Demand Plus 41 L/s Fire Flow at JU7 With High Lift Pump On and Standpipe at 15.7 m Depth.



Scenario 5B: Existing Conditions Maximum Day Demand Plus 41 L/s Fire Flow at JU7 With High Lift Pump On and Standpipe Depth at Bottom of Fire Storage, 8.0 m.



Scenario 6: Existing Conditions Static Conditions



EPA NET 2.0: Tabulated Nodal Results

Scenario 1: Existing Conditions Average Day Demand					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.01	332.89	34.24	48.70
Junc 2	298.28	0.04	332.89	34.61	49.23
Junc 3	299.09	0.02	332.89	33.8	48.07
Junc 4	298.36	0.05	332.89	34.53	49.11
Junc 5	298.2	0.06	332.89	34.69	49.34
Junc 6	299.92	0.06	332.89	32.97	46.89
Junc 7	298.36	0.69	332.89	34.53	49.11
Junc 8	300.04	0.05	332.89	32.85	46.72
Junc 9	303.47	0.07	332.9	29.43	41.86
Junc 10	309.72	0.1	332.93	23.21	33.01
Junc 11	312.96	0	332.97	20.01	28.46
Junc 12	307.22	0.05	332.94	25.72	36.58
Junc 13	304.06	0.09	332.91	28.85	41.03
Junc 14	303.24	0.04	332.89	29.65	42.17
Junc 15	301.31	0.06	332.89	31.58	44.92
Junc 16	301.01	0	332.89	31.88	45.34
Junc 17	306.61	0.06	332.89	26.28	37.38
Junc 18	308.91	0.12	332.89	23.98	34.11
Junc 19	300.23	0.03	332.89	32.66	46.45
Junc 20	301.67	0.07	332.89	31.22	44.41
Junc 21	300.09	0	332.89	32.8	46.65
Junc 22	300.59	0.05	332.89	32.3	45.94
Junc 23	300.2	0	332.89	32.69	46.50
Junc 24	303.24	0	332.89	29.65	42.17
Junc 25	303.47	0.02	332.89	29.42	41.85
Junc 26	298.65	0.04	332.89	34.24	48.70
Junc 27	298.51	0.04	332.89	34.38	48.90
Junc 28	299.7	0.04	332.89	33.19	47.21
Junc 29	302.78	0.03	332.89	30.11	42.83
Junc 30	310.06	0.07	332.89	22.83	32.47

Scenario 2: Existing Conditions Maximum Day Demand					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.02	332.55	33.9	48.22
Junc 2	298.28	0.08	332.55	34.27	48.74
Junc 3	299.09	0.04	332.55	33.46	47.59
Junc 4	298.36	0.1	332.55	34.19	48.63
Junc 5	298.2	0.12	332.55	34.35	48.86
Junc 6	299.92	0.12	332.55	32.63	46.41
Junc 7	298.36	1.26	332.55	34.19	48.63
Junc 8	300.04	0.1	332.56	32.52	46.25
Junc 9	303.47	0.14	332.58	29.11	41.40
Junc 10	309.72	0.18	332.69	22.97	32.67
Junc 11	312.96	0	332.82	19.86	28.25
Junc 12	307.22	0.1	332.71	25.49	36.26
Junc 13	304.06	0.16	332.61	28.55	40.61
Junc 14	303.24	0.08	332.57	29.33	41.72
Junc 15	301.31	0.12	332.56	31.25	44.45
Junc 16	301.01	0	332.56	31.55	44.87
Junc 17	306.61	0.12	332.55	25.94	36.90
Junc 18	308.91	0.21	332.55	23.64	33.62
Junc 19	300.23	0.06	332.55	32.32	45.97
Junc 20	301.67	0.14	332.55	30.88	43.92
Junc 21	300.09	0	332.56	32.47	46.18
Junc 22	300.59	0.1	332.56	31.97	45.47
Junc 23	300.2	0	332.55	32.35	46.01
Junc 24	303.24	0	332.56	29.32	41.70
Junc 25	303.47	0.04	332.56	29.09	41.38
Junc 26	298.65	0.08	332.55	33.9	48.22
Junc 27	298.51	0.08	332.55	34.04	48.42
Junc 28	299.7	0.08	332.55	32.85	46.72
Junc 29	302.78	0.06	332.55	29.77	42.34
Junc 30	310.06	0.14	332.55	22.49	31.99

Scenario 3: Existing Conditions Maximum Day Demand Plus 67 L/s Fire Flow at JU30 With High Lift Pump On					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.02	268.56	-30.09	-42.80
Junc 2	298.28	0.08	268.56	-29.72	-42.27
Junc 3	299.09	0.04	268.56	-30.53	-43.42
Junc 4	298.36	0.1	268.53	-29.83	-42.43
Junc 5	298.2	0.12	268.53	-29.67	-42.20
Junc 6	299.92	0.12	268.53	-31.39	-44.65
Junc 7	298.36	1.26	268.53	-29.83	-42.43
Junc 8	300.04	0.1	268.36	-31.68	-45.06
Junc 9	303.47	0.14	270.98	-32.49	-46.21
Junc 10	309.72	0.18	286.54	-23.18	-32.97
Junc 11	312.96	0	303.84	-9.12	-12.97
Junc 12	307.22	0.1	289.78	-17.44	-24.81
Junc 13	304.06	0.16	275.59	-28.47	-40.49
Junc 14	303.24	0.08	269.08	-34.16	-48.59
Junc 15	301.31	0.12	263.56	-37.75	-53.69
Junc 16	301.01	0	259.81	-41.2	-58.60
Junc 17	306.61	0.12	209.47	-97.14	-138.17
Junc 18	308.91	0.21	171.05	-137.86	-196.08
Junc 19	300.23	0.06	236.11	-64.12	-91.20
Junc 20	301.67	0.14	236.11	-65.56	-93.25
Junc 21	300.09	0	261.96	-38.13	-54.23
Junc 22	300.59	0.1	261.96	-38.63	-54.94
Junc 23	300.2	0	236.11	-64.09	-91.16
Junc 24	303.24	0	266.27	-36.97	-52.58
Junc 25	303.47	0.04	268.1	-35.37	-50.31
Junc 26	298.65	0.08	268.53	-30.12	-42.84
Junc 27	298.51	0.08	268.56	-29.95	-42.60
Junc 28	299.7	0.08	268.56	-31.14	-44.29
Junc 29	302.78	0.06	236.11	-66.67	-94.83
Junc 30	310.06	67.14	152.07	-157.99	-224.71

Scenario 4: Existing Conditions Maximum Day Demand Plus 38 L/s Fire Flow at JU30 With High Lift Pump On					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.02	312.61	13.96	19.86
Junc 2	298.28	0.08	312.61	14.33	20.38
Junc 3	299.09	0.04	312.61	13.52	19.23
Junc 4	298.36	0.1	312.59	14.23	20.24
Junc 5	298.2	0.12	312.59	14.39	20.47
Junc 6	299.92	0.12	312.59	12.67	18.02
Junc 7	298.36	1.26	312.59	14.23	20.24
Junc 8	300.04	0.1	312.51	12.47	17.74
Junc 9	303.47	0.14	313.28	9.81	13.95
Junc 10	309.72	0.18	318.2	8.48	12.06
Junc 11	312.96	0	323.71	10.75	15.29
Junc 12	307.22	0.1	319.17	11.95	17.00
Junc 13	304.06	0.16	314.63	10.57	15.03
Junc 14	303.24	0.08	312.58	9.34	13.28
Junc 15	301.31	0.12	310.74	9.43	13.41
Junc 16	301.01	0	309.4	8.39	11.93
Junc 17	306.61	0.12	291.58	-15.03	-21.38
Junc 18	308.91	0.21	278.04	-30.87	-43.91
Junc 19	300.23	0.06	300.99	0.76	1.08
Junc 20	301.67	0.14	300.99	-0.68	-0.97
Junc 21	300.09	0	310.17	10.08	14.34
Junc 22	300.59	0.1	310.17	9.58	13.63
Junc 23	300.2	0	300.99	0.79	1.12
Junc 24	303.24	0	311.71	8.47	12.05
Junc 25	303.47	0.04	312.38	8.91	12.67
Junc 26	298.65	0.08	312.59	13.94	19.83
Junc 27	298.51	0.08	312.61	14.1	20.05
Junc 28	299.7	0.08	312.61	12.91	18.36
Junc 29	302.78	0.06	300.99	-1.79	-2.55
Junc 30	310.06	38.14	271.38	-38.68	-55.02

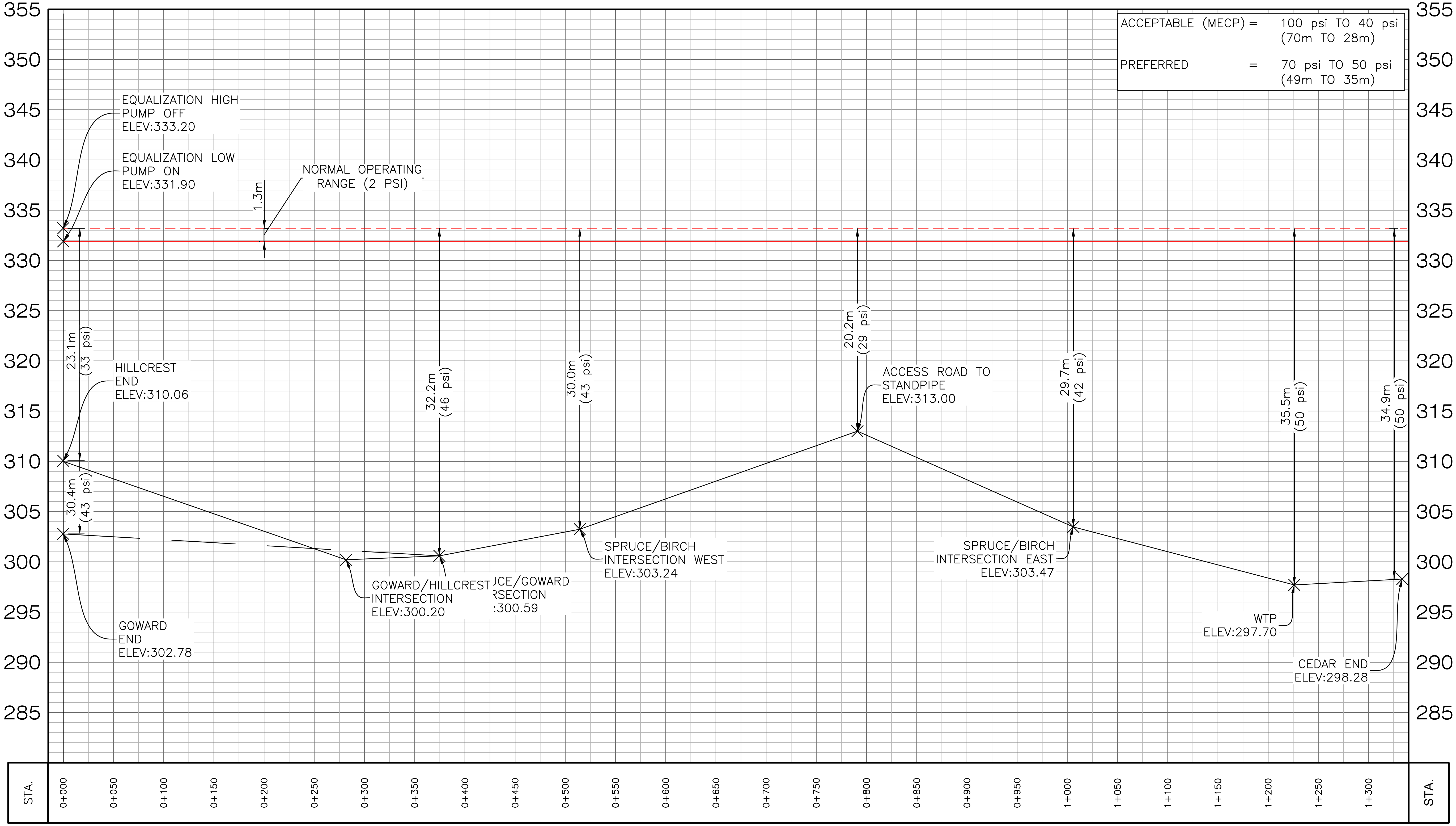
Scenario 5A: Existing Conditions Maximum Day Demand Plus 41 L/s Fire Flow at JU7 With High Lift Pump On and Standpipe at 15.7 m Depth					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.02	307.8	9.15	13.01
Junc 2	298.28	0.08	307.8	9.52	13.54
Junc 3	299.09	0.04	307.8	8.71	12.39
Junc 4	298.36	0.1	307.08	8.72	12.40
Junc 5	298.2	0.12	306.25	8.05	11.45
Junc 6	299.92	0.12	306.25	6.33	9.00
Junc 7	298.36	42.25	305.24	6.88	9.79
Junc 8	300.04	0.1	308.15	8.11	11.54
Junc 9	303.47	0.14	309.79	6.32	8.99
Junc 10	309.72	0.18	315.63	5.91	8.41
Junc 11	312.96	0	322.17	9.21	13.10
Junc 12	307.22	0.1	317.1	9.88	14.05
Junc 13	304.06	0.16	312.04	7.98	11.35
Junc 14	303.24	0.08	309.74	6.5	9.25
Junc 15	301.31	0.12	308.76	7.45	10.60
Junc 16	301.01	0	308.76	7.75	11.02
Junc 17	306.61	0.12	308.75	2.14	3.04
Junc 18	308.91	0.21	308.75	-0.16	-0.23
Junc 19	300.23	0.06	308.76	8.53	12.13
Junc 20	301.67	0.14	308.75	7.08	10.07
Junc 21	299.7	0.08	307.8	8.1	11.52
Junc 22	300.09	0	308.76	8.67	12.33
Junc 23	300.59	0.1	308.76	8.17	11.62
Junc 24	300.2	0	308.76	8.56	12.18
Junc 25	303.24	0	308.76	5.52	7.85
Junc 26	303.47	0.04	308.72	5.25	7.47
Junc 27	298.65	0.08	307.78	9.13	12.99
Junc 28	298.51	0.08	307.8	9.29	13.21
Junc 29	302.78	0.06	308.75	5.97	8.49
Junc 30	310.06	0.14	308.75	-1.31	-1.86

Scenario 5B: Existing Conditions Maximum Day Demand Plus 41 L/s Fire Flow at JU7 With High Lift Pump On and Standpipe Depth at Bottom of Fire Storage, 8.0 m					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0.02	301.45	2.8	3.98
Junc 2	298.28	0.08	301.45	3.17	4.51
Junc 3	299.09	0.04	301.45	2.36	3.36
Junc 4	298.36	0.1	300.73	2.37	3.37
Junc 5	298.2	0.12	299.9	1.7	2.42
Junc 6	299.92	0.12	299.9	-0.02	-0.03
Junc 7	298.36	42.25	298.89	0.53	0.75
Junc 8	300.04	0.1	301.77	1.73	2.46
Junc 9	303.47	0.14	303.33	-0.14	-0.20
Junc 10	309.72	0.18	308.86	-0.86	-1.22
Junc 11	312.96	0	315.04	2.08	2.96
Junc 12	307.22	0.1	310.25	3.03	4.31
Junc 13	304.06	0.16	305.45	1.39	1.98
Junc 14	303.24	0.08	303.28	0.04	0.06
Junc 15	301.31	0.12	302.35	1.04	1.48
Junc 16	301.01	0	302.35	1.34	1.91
Junc 17	306.61	0.12	302.35	-4.26	-6.06
Junc 18	308.91	0.21	302.34	-6.57	-9.34
Junc 19	300.23	0.06	302.35	2.12	3.02
Junc 20	301.67	0.14	302.35	0.68	0.97
Junc 21	299.7	0.08	301.45	1.75	2.49
Junc 22	300.09	0	302.35	2.26	3.21
Junc 23	300.59	0.1	302.35	1.76	2.50
Junc 24	300.2	0	302.35	2.15	3.06
Junc 25	303.24	0	302.35	-0.89	-1.27
Junc 26	303.47	0.04	302.31	-1.16	-1.65
Junc 27	298.65	0.08	301.43	2.78	3.95
Junc 28	298.51	0.08	301.45	2.94	4.18
Junc 29	302.78	0.06	302.35	-0.43	-0.61
Junc 30	310.06	0.14	302.34	-7.72	-10.98

Scenario 6: Existing Conditions Static Conditions.					
Node ID	Elevation	Demand	Head	Pressure	Converted Pressure
	m	LPS	m	m	psi
Junc 1	298.65	0	333.05	34.4	48.93
Junc 2	298.28	0	333.05	34.77	49.45
Junc 3	299.09	0	333.05	33.96	48.30
Junc 4	298.36	0	333.05	34.69	49.34
Junc 5	298.2	0	333.05	34.85	49.57
Junc 6	299.92	0	333.05	33.13	47.12
Junc 7	298.36	0	333.05	34.69	49.34
Junc 8	300.04	0	333.05	33.01	46.95
Junc 9	303.47	0	333.05	29.58	42.07
Junc 10	309.72	0	333.05	23.33	33.18
Junc 11	312.96	0	333.05	20.09	28.57
Junc 12	307.22	0	333.05	25.83	36.74
Junc 13	304.06	0	333.05	28.99	41.23
Junc 14	303.24	0	333.05	29.81	42.40
Junc 15	301.31	0	333.05	31.74	45.14
Junc 16	301.01	0	333.05	32.04	45.57
Junc 17	306.61	0	333.05	26.44	37.61
Junc 18	308.91	0	333.05	24.14	34.34
Junc 19	300.23	0	333.05	32.82	46.68
Junc 20	301.67	0	333.05	31.38	44.63
Junc 21	300.09	0	333.05	32.96	46.88
Junc 22	300.59	0	333.05	32.46	46.17
Junc 23	300.2	0	333.05	32.85	46.72
Junc 24	303.24	0	333.05	29.81	42.40
Junc 25	303.47	0	333.05	29.58	42.07
Junc 26	298.65	0	333.05	34.4	48.93
Junc 27	298.51	0	333.05	34.54	49.13
Junc 28	299.7	0	333.05	33.35	47.43
Junc 29	302.78	0	333.05	30.27	43.05
Junc 30	310.06	0	333.05	22.99	32.70

APPENDIX G

Hydraulic Grade Line Static (WM4)



No.	DATE	BY	ISSUES / REVISIONS
1	MAR. 24-2025	BB	ISSUED FOR REVIEW

TULLOCH

DRAWING:

HYDRAULIC GRADE LINE STATIC
(EQUALIZATION HIGH LEVEL / PUMP OFF & EQUALIZATION LOW LEVEL / PUMP ON)

PROJECT:

COMMUNITY OF TEMAGAMI NORTH
WATER STORAGE EVALUATION

DRAWN BY: SW	CHECKED BY: BB	PROJECT No. : 241337
DESIGNED BY: CS	APPROVED BY: CS	DRAWING No.: WM4
SCALE: V1:2,500 H1:800	DATE: MAR. 24, 2025	REVISION No.: 1

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